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Cover photograph by courtesy of Forest Research Institute, Dehra Dun, India: The Forest Research Institute in its magnificent setting against the outer Himalayas.

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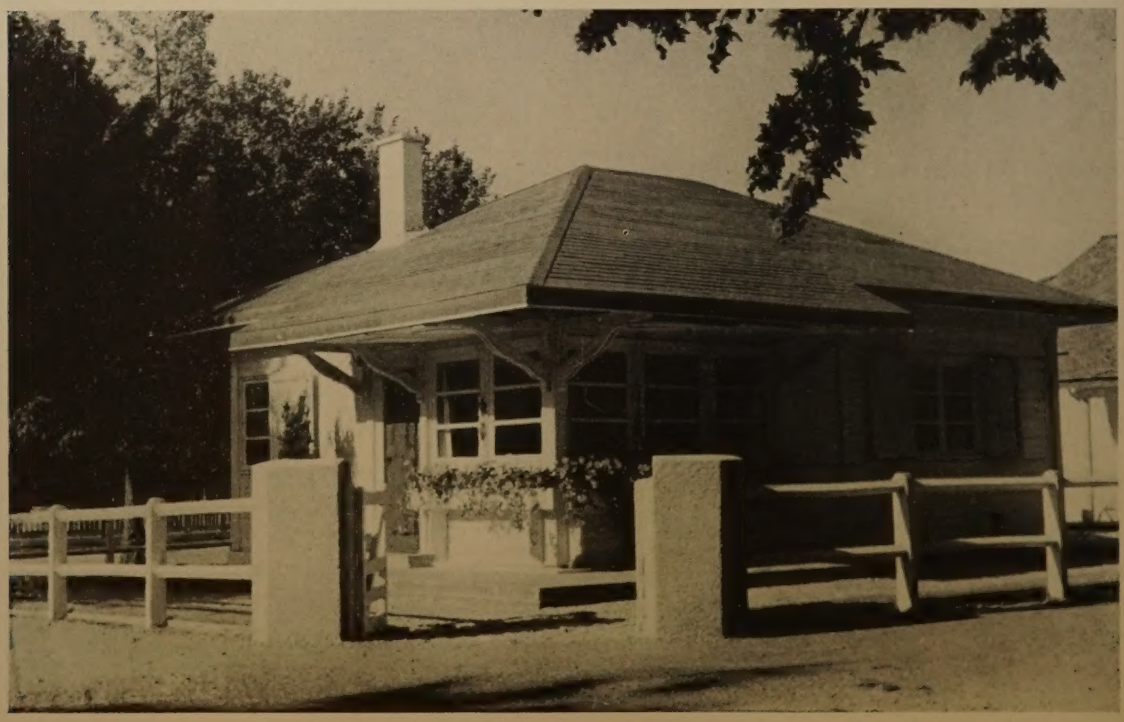
Reconstructed section of Béthune (Pas-de-Calais), France

Model prefabricated house of French manufacture; made of wood or composition panels.



The European Housing Problem

By the STAFF OF FAO'S DIVISION OF FORESTRY AND FOREST PRODUCTS

HUNDREDS of photographs and articles have acquainted the world with the destruction caused by the war in the various European countries and the fact that a European housing problem exists. The ruins left in Europe in the war's wake have dramatized to the world the European housing problem. The horrors of Europe's rubble-filled streets, the pictures of gaunt swaying walls overlooking acres of devastation have familiarized the world with the fact that sheltering Europe's millions is one of the major tasks of the next decade. The Housing Sub-Committee of the Economic Commission for Europe has issued a survey on the European housing problem (a preliminary review) which covers the following 17 European countries, containing 43 percent of the total European population: Austria, Belgium, Czechoslovakia, Denmark, Finland, France, Greece, Hungary, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Sweden, Switzerland, and the United Kingdom. Europe throughout this article refers to the above-mentioned countries.

As the preliminary review points out, the Continent's housing problem has not been caused exclusively by the war, but dates much further back. Its origins can be traced to the first half of the 19th century, the days of the industrial revolution when a constant and rapid rise in population and a steady increase in industrial population led to an ever-growing need for more housing accommodation.

This need was seldom satisfied even in terms of quantity, but quality of the housing provided was even worse, and throughout the 19th century overcrowding and insanitary living conditions were met with in most European industrial centers. Although conditions improved somewhat in the early years of the 20th century, two world wars and the continuing rapid rise in population, as well as Europe's further industrialization, aggravated the problem to a point where housing after the war became a main problem in the recovery of many European countries.

By 1950, the problems of restoring production and transport, which during the immediate postwar years had been accorded top priority, have been largely solved, but today housing represents one of the most intractable internal problems with which the governments of Europe must grapple.

Housing is far more than a grave social problem; it is of considerable economic importance, since the accomplishment of many tasks with which the governments are faced depends in a large measure on the availability of housing accommodation for the workers and their families. As private industry is unable to cope with it, owing to the magnitude of the task and more particularly owing to the fact that the need is for low-rent housing which does not provide the building industry with the necessary profit incentive, governments have generally entered the housing problem as part of their social and economic policies.

During the last 100 years, Europe's governments have been compelled to take a more and more active interest in housing. Some states have discharged this responsibility by building houses, but more often the problem has been handled by establishing a housing policy laying down minimum standards of construction and paying direct building subsidies or through general financial policy.

Most of the present European governments have been elected on programs which contain promises of some solution of the housing problem, and electorates are now pressing for the fulfillment of these promises. On the other hand, all European governments are committed to anti-inflationary policies and are forced to maintain carefully their foreign trade balances. The housing programs which these governments therefore have been able to evolve are confined by several limits.

The Problem

In 1939, Europe's total housing facilities amounted to roughly 65 million dwellings, comprising 205,700,000 rooms, while annual building construction proceeded at the average rate of about 824,000 dwellings per annum.

The war damage amounted to:

2,800,000 dwelling units totally destroyed;
2,900,000 dwelling units partially destroyed;
8,900,000 dwelling units slightly damaged.

By the end of the war, approximately 5,700,000[1] dwellings had thus become uninhabitable, and a further 9 million needed minor repairs.

Taking into account repairs of damaged houses and construction of new dwellings, the European stock of housing presented the following picture by the end of 1947:

Inhabitable buildings	22,800,000
Dwellings	62,400,000
Rooms	196,800,000

The population of the 17 countries covered by the ECE preliminary review amounted to 243 millions in 1939. By 1945 this number had been decreased by around 6 millions, and from this time on it gradually began to increase again, reaching 239 millions in 1947 and 243 millions in 1949. In other words, by the end of 1949 the population of Europe had practically caught up with the severe losses caused by six years of war. Table 1 outlines country by country the change in population and, wherever possible, gives the room per caput figure in the individual countries:

In spite of the reduction in population, the damage caused to European housing during the war period had reduced the average rooms per caput from 0.833 to 0.803. Working on the basis of these average room per caput figures, it appears that at the end of 1947 the European countries surveyed were roughly two million rooms short of the 1939 living standard.

It is estimated that the total number of dwelling units required in Europe in order to return to the prewar housing standard would amount to about 3,100,000, which would be equivalent to roughly three and three-quarter times the prewar annual output of the building industry.

[1]The aggregate of totally destroyed and partially destroyed dwelling units.

Repairing the war damage, however, is only a minor part of the total task ahead. The 1939 housing standards were very inadequate and it is estimated that to relieve overcrowding, to replace unhealthy and unsafe buildings, more than 11 million dwellings need replacement. Current annual building needs to provide for the annual increase in population in the number of families or the number of household units, and secondly for the replacement of over-age obsolete buildings, are set at 965,000 dwelling units per annum.

In round figures, the problem presents itself as follows:

3,100,000 dwelling units to regain 1939 standards;
11,100,000 dwelling units to improve on 1939 standards;
1,000,000 dwelling units for additional annual current need.

The Housing Problem in Germany

Owing to the scarcity of available data on the housing situation in Germany and the incomparability of statistics from the different parts of Germany, the ECE preliminary review did not incorporate the German figures in its statistical survey. In a separate appendix, however, it deals in broad lines with the problem in the different zones of that country.

The appalling housing conditions resulting from the war were aggravated by the mass arrival of refugees from countries outside Germany, as well as by the displacement of persons within the zones themselves.

In the *French Zone of occupation*, where 1,350,000 dwellings had been available before the war, 955,000 (70 percent of prewar) were available after the war. By the end of 1949 total available dwellings had been brought up to 1,092,500 (80 percent of prewar). Taking into account the number of refugees that have to be housed and the normal population increase, it is stated that 300,000 additional dwellings are required by 1952-53 to restore prewar housing standards. It is, however, envisaged that not more than about 90,000 new dwellings can be obtained from repaired or new construction within the next three or four years.

TABLE 1.—ROOMS PER CAPUT IN RELATION TO CHANGES IN POPULATION

Country	Population (1,000's) 1939	Rooms per caput 1939	Population (1,000's) 1945	Population (1,000's) 1947	Rooms per caput 1947	Population (1,000's) 1949	Decrease 1939-49	Increase 1939-49
Austria	6,658	...	6,799	6,920	...	7,090		432
Belgium	8,391	1.07	8,339	8,421	1.01	[1]8,557		166
Czechoslovakia	14,683	...	14,152	12,164	...	12,463	2,220	
Denmark	3,805	0.87	4,045	4,146	0.88	4,230		425
Finland	3,686	...	3,781	3,896	...	4,042		356
France	41,300	0.93	39,100	40,300	0.88	41,180	120	
Greece	7,156	0.52	7,288	7,550	0.40	[1]7,780		624
Hungary	9,217	0.38	9,025	9,093	0.39	[2]9,165	52	
Ireland	2,934	0.80	2,983	2,972	0.82	2,991		57
Italy	43,112	1.16	44,689	45,373	1.06	46,001		2,889
Luxembourg	300	...	283	289	...	[1]292	8	
Netherlands	8,781	0.76	9,262	9,629	0.69	9,955		1,174
Norway	2,929	0.91	3,059	3,163	0.85	3,233		304
Poland	32,100	0.52	[2]23,930	23,781	0.58	[1]23,900	8,200	
Sweden	6,326	0.67	6,636	6,803	0.72	6,956		634
Switzerland	4,206	1.00	4,403	4,547	0.98	4,645		439
United Kingdom	47,762	1.26	49,182	49,571	1.19	50,363		2,601
TOTAL	243,346		236,956	238,618		242,843		

.. Not available.
[1]1948 figure.
[2]1946 figure.

A reconstruction project that takes into account traditional local architecture. Amiens, France.

In the *United States Zone of occupation*, 1,375,200 dwellings (65.1 percent of prewar) were available by the end of November 1947. Total population in that year was 92.3 percent of that of 1939. The average number of rooms per caput was 0.55, compared with 0.78 prewar.

The needs in the *British Zone of occupation*, according to a report of the building industries branch of the Control Commission in October 1948, amounted to 5,800,000 "dwelling unit equivalents." At prewar rates of output this volume of building would require 8,700,000 man-years of labor, and it was estimated that an annual force of nearly 350,000 men would be needed to do the job in 25 years. The removal of rubble alone constitutes a special problem. In order to clear the 200 million cubic meters in the British zone in 10 years, an annual labor force of about 70,000 men would be required. If the rubble were to be moved by rail, it would require 370 50-truck trains every working day.

The *Bizone* housing program for 1949-50 considers it of the utmost importance to build during that period at least 125,000 apartments, as well as the appropriate public services.

Although detailed information is lacking from the *U.S.S.R. Zone of occupation*, it has been indicated that in 1949 the supply of building materials was twice as great as during 1948 and was used mainly for new houses for workers in industrial and agricultural areas and for repairs in the larger cities. The 1949 building program provided for the reconditioning of 68,500 damaged houses. As can be seen from these scanty figures, the housing problem in Germany represents a far greater task than the combined housing problem in the 17 countries covered by the statistics of the preliminary review.

The Solutions

The Economic Commission's preliminary review set up what it called the "necessary program," which, if applied, would solve the European housing problem within 22 years. It represents an attempt to satisfy total housing needs within a reasonable time on the basis of a rate of building activity which, although extremely unlikely to be achieved under present conditions, is theoretically a possible one.

To put the "necessary program" into operation, building material would have to be produced at the rate of 200 to 300 percent of prewar production. It would, for instance, call for a timber delivery to the housing industry of 16.1 million cubic meters per annum. This program would involve tremendous efforts by the various national economies and demand a raw material supply far beyond not only the financial possibilities of the various countries, but also beyond the capacity of the raw material producing industries. It is obvious therefore that nothing like the "necessary program" can be carried out under present conditions, and in fact none of the existing European housing programs aims at any such "short-term solution."

As an alternative the preliminary review evolved a probable program which is based on a realistic estimate of what countries could achieve. In some cases, this estimate may be optimistic, although in others the activity has already surpassed the ex-

Clearing a bomb-site in the London dock area. In the background are surviving old houses which will be pulled down.

pected program. This "probable program" shows a progressive rise from 92 percent of the 1939 rate, which had been attained in 1948, to 155 percent of the 1939 rate, which should be attained by 1952.

Even the execution of the "probable program" would strain the resources of many European countries, none of which would find even such a comparatively modest contribution to the solution of the housing problem an easy one. The "probable program" for 1948 involved an annual timber supply of approximately 7,200,000 cubic meters (roughly 90 percent of the prewar consumption of 7,800,000 m^3). As it is estimated that 25 to 30 percent of sawn wood production is used by the housing industry, this would have necessitated a total sawn softwood output of 23 to 28 million cubic meters. In 1948 European sawn softwood output amounted to about 32 million cubic meters and amply sufficed to cover the timber needs of the "probable program" for that year. Progressive increases of building activity in the following four years would bring the timber supply necessary for the execution of the "probable program" up to approximately 12 million cubic meters by 1952, which would correspond to a total European sawn softwood output of from 36 to 48 million cubic meters. It is, however, extremely unlikely that European sawn wood production, which with great efforts reached 35 million cubic meters in 1949, can be extended to cover these demands.

Furthermore, it should not be overlooked that the figures of the preliminary review did not take into account the needs of the German housing program and that furthermore 1948 and 1949 represent peak years of postwar sawn wood production.

If the governments of Europe find it possible to undertake housing programs at a rate equal to the "probable programs," the European housing problem could be solved within 50 years on the average, although in some countries it might take 150 years to achieve the desired goal.

It must be pointed out that no European government has committed itself to the execution of these "probable programs." While in some countries actual building activity now in progress approaches the "probable program" outlined by the preliminary review, building results in most countries fall short of the "probable program" targets, as building plans are cut to suit financial conditions and the availability of building material and of skilled manpower. In fact, the building programs have without exception been adjusted in advance to correspond with available material, so that none of them have been held up by lack of material except in a few local and isolated cases.

The Difficulties

The greatest difficulties which European governments meet in carrying out and expanding their building programs are financial ones. They far overshadow the difficulties encountered in the supply of building material and skilled manpower. The magnitude of the problem and the necessity of providing large numbers of low-rent dwelling units have forced most European governments to subsidize their building programs heavily. It will prove more difficult for them to go any further without taking the risk of putting their financial policies in jeopardy The existing building programs not only affect the domestic financial policy, but also threaten to disturb trade balances, as a considerable amount of building material must be imported.

While some governments have resorted to direct subsidy, others have initiated building programs financed and carried out entirely by the state itself.

As was mentioned, no serious building material shortage at present exists within the framework of the housing programs set up by the various European governments. Up to 1947, the shortage of building materials, particularly of steel, timber, and cement, was pronounced, and in several countries the housing programs were hampered by the lack of either one or more of these materials. It must be kept in mind that a balanced supply of steel, timber, cement, glass, bricks, and asbestos, as well as an assured supply of pipes, sanitary fittings, etc., is essential to the execution of a building program. An abundant supply of timber or steel, for instance, which a country might have at its disposal at one time or another, would not

in itself do away with the shortage of building materials.

Since 1947, the situation has greatly improved so far as building materials are concerned, and within the framework of the present programs no important material shortages are likely to develop. Should financial conditions improve, however, and governments for one reason or another find themselves in a position to expand their housing program, a shortage of essential building materials would be very likely to develop within a short time.

What has been said concerning the building material position applies equally to the supply of skilled manpower. Present programs can be executed with the manpower available, particularly as a large reservoir of qualified building laborers is available in Italy, which is drawn upon not only by neighboring countries but also by more distant countries of Europe.

Timber's Role in European Building

Despite considerable economy and the substitution and development of new building materials, the pattern of materials in house construction is not markedly different from that in use before the war. Basically the building methods employed are still the same.

The high price of timber, and its shortage during the first four postwar years, gave a strong impetus to the trend to save timber wherever possible. It is symptomatic that in 1947 all but four European countries, namely, Finland, Sweden, Norway, and Switzerland, reported more or less acute timber shortages. Even such timber-producing countries as Austria and Poland reported shortages due to overexploitation of forests during the war and to the lack of hauling equipment. All other countries covered by the preliminary review (Belgium, Czechoslovakia, Denmark, Ireland, Italy, Greece, the Netherlands, and the United Kingdom) reported timber shortages due to the low level of imports, which in turn is a result of shortage of foreign exchange. While Poland suggested economy measures and utilization of waste as a remedy for the timber shortage, Austria suggested increased imports of coal, modernized equipment, and skilled foreign labor. All other countries suggested as the only remedy increased imports, a fact which clearly shows that even in 1947 the timber shortage was primarily a question of foreign currency.

Forced either to import timber to carry out their building programs or to save as much timber as possible in order to increase the exportable amount of that valuable raw material, most countries adopted stringent measures of economy in the use of timber in their house-building industries.

The estimated average requirements of timber per dwelling unit are shown in Table 2, page 104.

This table shows the surprising fact that in Austria timber requirements per dwelling unit are nearly three times as high as prewar, which seems to be due mainly to a shortage of cement, while timber requirements have remained stable in Czechoslovakia, Denmark, Finland, France, Ireland, Norway, and Switzerland. All other countries have been able to reduce timber requirements per dwelling unit by 10 to 20 percent.

Attempts have been made to save timber in two ways: (1) by using substitute materials, and (2) by a more economical use of timber.

For reasons already mentioned, a great number of substitutes were used in the building industry during the immediate postwar years. However, substitution in the long run frequently proved self-defeating, as many types of substitutes were in themselves uneconomic. Some measures of substitution, however, particularly the use of entirely new materials, seem to have come to stay. Concrete joists and floor boards on solid filling have been substituted for timber in floors, and a wide range of other substitute materials such as wallboards, aluminum, and other floor coverings have been used either in association with or instead of concrete.

The answer to the question whether application of these substitute materials will prove economic in the long run can be given only when market conditions have returned to normal and competition can determine which material will be used by the building industry. It is, however, safe to say that many of the

A badly bombed district of London now transformed into a modern garden city.

materials developed from wood waste or from locally available products will find a permanent place.

TABLE 2.—AVERAGE TIMBER REQUIREMENTS PER DWELLING UNIT

Country	1938	1949
	(..... *Cubic meters* .....)	
Austria	4.6	12.0
Belgium	19.9	8.5
Czechoslovakia	14.5	14.5
Denmark	9.6	9.6
Finland	11.7	11.7
France	7.0	7.0
Greece	9.9	6.2
Ireland	9.9	9.9
Italy	4.6	4.2
Netherlands	11.2	10.4
Norway	33.3	33.3
Sweden	25.8	28.2
Switzerland	22.3	22.3
United Kingdom	9.1	7.3
Average	13.7	12.8

Practically all countries have adopted stringent measures to reduce the use of timber in building construction. Measures of economy in the use of timber include treatment with effective anti-pest products and the application of more rational building principles. Another development is the standardization of joinery by fixing dimensions and limiting the number of types of components manufactured; several countries have now adopted stock types for doors, door frames, and casements which are being mass-produced.

In this connection the manufacture of prefabricated houses should be mentioned, which since the war has increased considerably. While prefabricated houses for a long time had been looked upon as temporary structures which were used only in emergencies, modern construction has enabled the prefabricated house industry in some countries, such as Finland and Sweden (see Table 3) to attain important proportions, and domestic consumption as well as the export trade of this product has been steadily rising since the end of the war.

TABLE 3.—EXPORTS OF PREFABRICATED TIMBER HOUSES

Country	1945	1946	1947	1948	1949
	(. . . *In tons* . . .)				
Finland[1]	37.950	121.806	148.881	159.181	180.222
Finland[2]	43.765	35.820	16.092	2.491	. . .
Sweden	17.401	71.439	17.505	9.675	44.527

. . . Not available.
[1]Commercial exports.
[2]Finnish war reparation deliveries to the U.S.S.R.

Conclusion

The magnitude of the task of solving the European housing problem can be gauged by the fact that it will take some 50 years, on the average, to get rid of all houses which by present standards are considered unsafe and unhealthy—either as a result of war damage, obsolescence, or other causes—provided no further disturbances impede the execution of large-scale housing programs. The solution of the problem is dependent largely on the financial ability of the various governments to provide the necessary low-rent housing which is adjusted to the purchasing capacity of the working population.

The part which timber will play in the solution of the problem depends on a great number of imponderables such as price developments in timber and substitute materials, general financial and economic developments, future developments in the wallboard industry, and a great number of other factors. It is clear that demand for building timber in the next decades will continue to be strong; and in spite of all substitution and economy, timber will be called upon to play a major part in the solution of the European housing problem.

Photographs, pp. 98 and 101 courtesy of French Embassy Information Division and pp. 102 and 103 courtesy of British Information Services.

Communication through Literature

By RALPH R. SHAW
The Librarian, United States Department of Agriculture Library

The availability of recorded knowledge is of great practical importance to those working in the fields of forestry and forest products. The modern techniques offer increasing possibilities and bring new concepts of documentation within our reach. Mr. Shaw is not only an eminent librarian but also the inventor of a new Rapid Selector, an electronic device giving ready access to the great mass of literature accumulated on the subject of agriculture, forestry, and fisheries. He very modestly describes the possibilities of this machine without mentioning his own share in its development.

He has already perfected a system for making available literature stored by the library of the U. S. Department of Agriculture through the medium of microfilm reproduction. The possibilities of this system were discussed at the 1949 session of the FAO Conference, and efforts are being made to extend such a service to all member countries. In practice, this would mean that anybody who sees an article or a book listed in the FAO Bibliography of Forestry and Forest Products *could write to FAO and obtain microfilm copies, either positive or negative, up to any length for a very modest fee.*

This would be truly a great service; in many war-damaged areas library collections of periodicals and other scientific material have been destroyed. Many of them, especially the older publications, are irreplaceable. Now such material would become available once more. However, certain difficulties must first be overcome: one is the question of copyrights, which is being explored, and the other is the problem of payment of the fee involved. The fee is not large, US$1.00 for the reproduction of each 50 pages or fraction thereof from a single article or book, and it is only the present currency restrictions in soft currency countries that have to be overcome. It is hoped that the discussions under way on both questions will lead to a satisfactory solution.

However, as Mr. Shaw points out, the great problem is how best to make use of the new tools that scientific development is beginning to place at our disposal. Concerted thinking will be necessary to determine this. The joint bibliographical committee set up by FAO and the International Union of Forest Research Organizations has already begun work in that direction, and this is a starting point, we hope, for the international co-operation that must be achieved.

PEOPLE scattered all over the globe must work together if any of the objectives of international organizations are to be achieved. Communication is, therefore, a basic problem of all international organizations. It is, in fact, the blood stream and the nervous system of an international organization. If the heart fails to pump the blood stream of technical information to the outermost extremities, the fingers and hands and feet and legs will fail to develop—they will wither and die, and the body will be immobilized and will stagnate. If the nervous system fails to convey warning signals from the extremities to the central intelligence and back out to all the parts concerned, then the vicissitudes of corporate life will whittle away the extremities and again the international body will stagnate and stultify.

Early in its history, FAO recognized the fundamental nature of its interest in communication through literature and called an informal meeting of experts on statistical, scientific, and technical information, which met in London on 10 April through 13 April, 1946.[1]

* * *

In the communication system of any international body, there are only three basic methods for obtaining or transmitting information.

The first of these, which is used most commonly because it is the simplest, cheapest, and most convenient, is personal contact. Obviously, when an expert is at hand, and the subject is not controversial, we ask him and get the answer. This may be done by personal visit, or by telephone, mail, or telegraph, etc. The

[1] *FAO Information Service Bulletin*, Vol. I, No. 4, 17 June 1946.

newly developing technical aids, such as "facsimile" reproduction, may be expected to reduce the cost and extend the usefulness of the person-to-person type of communication.

The second major means for obtaining information is research. This method requires large expenditures of time and money. It involves making laboratory studies or sending missions to observe on the scene, to discuss with many, and to reach conclusions. Research is necessary when information which is required does not exist and must be created. But since research methods are expensive and time-consuming, they can be applied only to a limited part of the universe of knowledge which is required for effective functioning of an organization of wide interests.

The third fundamental method for obtaining information—consultation of the recorded knowledge—is related to both the first and second methods. The printed word is neither more nor less than the judgment of a specialist in recorded form. Our files and our libraries are really vast collections of expert opinions in formal, recorded form. Consulting the literature is, therefore, the same type of operation as person-to-person contact, except that much more latitude is possible because an effective documentation service can permanently assemble all the experts of all times and places, and bring all their testimony to bear whenever and in whatever form the information may be required.

These three methods of obtaining and disseminating information are inextricably interwoven into the fabric of any international organization, and it is only through wise use of all three that FAO can hope to approach its goals.

Communication in an international organization is a two-way street. Information must flow inward to a center where it can be organized, synthesized, and evaluated; but it must also flow out to every member nation and to the individuals in every member nation if the headquarters is to be more than an ivory tower housing bureaucrats whose heads are in the clouds and whose lofty ideals lack reality because they lack contact with the solid earth on which agriculture, forestry, and fisheries programs must be built.

It would appear obvious that FAO must carry its findings to *users* in all lands through a dynamic publishing program. Since publishing reports of meetings, surveys, and findings is one of the principal tools of communication, FAO must, as a minimum, have a publication program which will make the knowledge created by FAO meetings, missions, technical assistance, and research programs available to all its members.

The responsibility of FAO for disseminating knowledge which it has not itself created is not so positive. Nevertheless, if one of the purposes of FAO is to advance knowledge in the fields it covers, very much might be done by calling important information to the attention of those who need it, regardless of whether this knowledge was created by FAO, by its member governments, or by others.

The limits to which such services can be carried are determined by very practical considerations. Obviously, FAO cannot have enough money to publish all the world's literature on agriculture, forestry, and fisheries, in many language editions and in quantities sufficient to supply a copy of every item to every agriculturist, forester, and fisherman in each participating country; and even if such funds were available, such unlimited distribution would be fantastically wasteful of money which might better be used to create new knowledge. Nor can the problem be adequately approached by attempting to build up complete libraries in each country, for few countries are rich enough to support a great agricultural research library.

It would appear from the above that, while we say on the one hand that communication through the use of literature is absolutely indispensable to effective international work, we say on the other that such communication is impossible. The explanation of this paradox lies in recognizing that we may have been confusing the physical objects through which knowledge is customarily conveyed with the knowledge itself. By the use of some of the newer techniques of documentation, it should be quite possible for FAO to build up the potential for research and to help in making technical information available in its member countries without building up great research libraries in each or making unlimited distribution in each.

The minimum requirement for communication of knowledge contained in literature, in addition to such dissemination as can be made through FAO's own publications, is, first, the establishment of mechanisms through which anyone in the world can find out what has been done anywhere in the world.

In some fields, such as chemistry, the presently available abstracting services do an excellent job of letting people know what has been published. In others, such as agriculture, the *Bibliography of Agriculture*, published monthly by the U. S. Department of Agriculture Library, provides a current index to a large portion of the world's knowledge. And many similar services, including the abstracting services of the Commonwealth Agricultural Bureaux, Biological Abstracts, and others, are now available. If FAO could stimulate the improvement and wider distribution and use of such tools as these, then eventually anyone in the world could, by the use of the pertinent indexing and abstracting journals, find out what is known anywhere in the world which would help him to solve his own problems.

However, knowing that a publication exists is not the same as having the publication in hand, and, in many cases, neither index entries nor abstracts can substitute for the complete report. Mechanisms which enable low-cost copies of pertinent articles to be obtained in any part of the world are therefore essential. This type of service is necessary in the great centers of research as well as at outlying points, because there is no center which has all recorded knowledge. The removal of deterrents to the free flow of knowledge, such as currency difficulties and tariff restrictions, would benefit all the member countries of FAO by making the technical information on agriculture, forestry, and fisheries more easily available to them. Possibly in co-operation with other UN agencies such as UNESCO, FAO could profitably work toward this end.

But while the current indexing and abstracting services, together with international inter-library loan services and photographic copying services, might greatly reduce the differential in research and in practical information, it is not the whole story. Obviously, no one of us can read all of the languages in the world; so translation of information into other languages is one requirement. Furthermore, not all

information needed is current, and in many cases extended searches, going back over a long period, must be made. The number of indexing and abstracting services is so great that it is not even feasible to build up complete files of all of the indexing and abstracting journals at every point where research must be done, nor is it economically feasible for the technical worker or bibliographer to search through all of these volumes on every subject on which information is needed. In these two areas great possibilities are emerging through the new electronic machines which have been developed. At the present time an electronic computer is being developed in California which shows real promise of serving as a translating machine, capable of storing hundreds of thousands of words in many languages and automatically converting from one language to another. While there are many problems to be worked out, it does not appear impossible to expect that electronic machines will do at least rough draft translations for us in some areas within the next ten or fifteen years. A second electronic machine of interest has been developed by the U. S. Department of Agriculture Library. This machine, called the Rapid Selector, can store any number of abstracts or pages of text and can search through them at the rate of 120,000 subjects a minute, making copies of the pertinent abstracts as it runs through the searching process. More will be said about this machine below.

The ultimate objective should be to make all the technical information on agriculture, forestry, and fisheries accessible to anybody who needs it, no matter where he may be located, in order to increase research potential and thus contribute to the attainment of the goal set for FAO by its Constitution—that is, to better the standard of living of the peoples of the world.

Past Experience

One particular example in this field, the experience gained by the U. S. Department of Agriculture, can serve as illustration:

The problems faced by the Department in providing knowledge about agriculture to its employees, as well as to the country as a whole, are not greatly different from those of international organizations. The methods reported below, therefore, are an indication of the ways in which one institution has attempted to meet the problem of communication through literature. While they fall far short of solving the problem and will differ in some respects from the problems faced by other types of organizations, they may be of some interest.

Through intensive effort over a number of years, and through co-operative exchange arrangements with institutions of other countries, the Department of Agriculture has built up a large research collection of literature of agriculture and related sciences. However, that collection is housed in Washington, and four-fifths of the staff of the Department are scattered around the country outside of Washington. With our great expanses of land area, many of our agricultural workers are stationed at distances of two or three thousand miles from Washington, and they are no better equipped by the collection in Washington than is someone in South America who wants information services from FAO. Obviously, it is not possible to duplicate this great research library at all points in the United States. Yet the staffs of all the research stations must have access to the information that is pertinent to their work. For example, with major sheep research stations in Idaho and New Mexico, the literature of sheep research, which cuts across a wide range of types of literature, is just as essential in these states as it is in Washington. Our solution to this problem has been a combination of regional branches, each with a limited potential for service but able to provide quick information service in the areas of information most commonly requested, with *documentation services*. Our documentation services, in theory at least, raise the research potential at all points to the same level so far as use of the knowledge contained in literature is concerned.

The *Bibliography of Agriculture*, which is issued monthly, lists every significant article and publication about agriculture received each month in the Department from all over the world. It is classified in accordance with the preferences of workers in the various subject fields and goes to all offices of the Department. By spending fifteen or twenty minutes once a month reading through the pertinent sections of the *Bibliography of Agriculture*, any worker in the Department can find out what has been published almost any place in the world that will help him do a more effective job. Then, if the publication is not available from a local library, he can write to the Department of Agriculture and get a photostatic copy of the article without charge. Thus, we have perfected a chain of current information services which is quite independent of the building up of multiple research libraries, and which works. During the average year the Department Library circulates more than 1,500,000 volumes, answers more than 200,000 questions, and supplies a million or more pages in microfilm or photostatic copies.

The same service is provided to those who are not members of the staff of the Department of Agriculture, except that they must either obtain the *Bibliography* on exchange or purchase it from the Superintendent of Documents for a moderate fee, and they pay a very modest fee for copies of articles required for their work.

In order to achieve these services, new bibliographical methods had to be devised which could handle the great mass of literature that pours into the Department of Agriculture Library annually. More than 900,000 pieces of periodical literature come in each year, and of these 300,000 must be added to the permanent collection. The latter group, representing the issues of some 18,000 different periodical publications and annual reports, must be individually handled by professional staff to select the articles to be indexed and to indicate under what subjects they are to be indexed. Since the *Bibliography of Agriculture* now covers more than 80,000 articles and books each year, the size of the task of issuing a truly current bibliography can well be imagined. Production of the *Bibliography of Agriculture*, which averages over 3,000 pages a year on a monthly schedule, requires close cooperation of all of the groups working together. The scheduling of this operation more closely resembles an industrial operation than one that is normally associated with libraries.

The chief shortcoming of the *Bibliography of Agriculture* rests in our failure to receive all the agricultural publications issued all over the world so that

they may be included in this one comprehensive index. This is true in spite of the fact that we are quite willing to pay for publications in our field issued in the trade in other countries and, of course, are glad to extend exchange arrangements with institutions which will send us their publications in return for the publications of the Department of Agriculture. While the *Bibliography of Agriculture* does not do the whole job of current information, it provides as complete a listing as possible so that abstracting journals and review journals have a firm base from which to select the material which needs to be abstracted or reviewed and are relieved from the necessity of providing a checklist of the world of literature.

However, information about what is available is only part of the job of communicating agricultural knowledge. It is very rare that an entry in the *Bibliography* will replace the need for access to the article itself. Rather, it stimulates the desire for the original article. Since complete collections cannot possibly be built up at all points in the country, and since loan of publications is a slow and uneconomical process for satisfying all needs, the Department of Agriculture Library has laid great stress on its photographic copying services. This process is now developed to the point where photostatic copies of articles can be provided more cheaply and more promptly than the original can be loaned. The express charges alone for lending a volume and returning it from any other library in the United States would be higher than the cost of supplying a photographic copy, which need not be returned.

These services are available to all co-operating countries. The *Bibliography of Agriculture* is sent to other institutions in exchange for their publications, and, in the case of those which do not have publications, may be purchased from the Superintendent of Documents for US$8 per year. A microfilm copy of any article can be supplied for US$1 for each 50 pages. Thus, theoretically, the Department of Agriculture Library makes its documentation services available to workers in agriculture not only in the United States but all over the world. The chief difficulty, of course, is the dollar shortage, which makes it very difficult for many foreign workers to obtain U.S. currency to pay for a microfilm. FAO could greatly advance technical knowledge of agriculture, forestry, and fisheries all over the world by encouraging a wider international exchange of publications so that the *Bibliography of Agriculture* will constitute a more complete guide to the knowledge of agriculture, forestry, and fisheries, and by finding a solution to the problem of currency restrictions on these petty cash transactions in scholarly equipment.

The program outlined, however well it takes care of current information service, does not take care of the problem of literature searching, which is still an arduous and time-consuming task. Extensive searches require the handling of one or more volumes of a hundred or more different indexing and abstracting services. Thus, a complete search of the literature may take anywhere from one to two-and-a-half man-years; and a large portion of this time is spent in merely handling the indexes and picking out the items that must be examined, many of which will later be discarded because they prove to be not pertinent. After studying the potentialities of the various mechanized systems available, it became quite clear that new devices operating at much higher speed and much higher flexibility would be required to meet our real needs for extensive searching of literature.

An electronic machine recently developed in the Department of Agriculture Library, in its first model, stores 72,000 abstracts and 430,000 index entries to those abstracts in a quarter of a cubic foot. This means that a section of wall-shelving approximately eighteen feet long, seven feet high, and fifteen inches deep can hold 20 million abstracts or pages of periodical or book literature, together with 120 million index entries to that literature. The literature can now be searched at speeds in excess of 100,000 subjects a minute, and copies of the abstracts or pages of the literature can be made as the machine searches for the material.

The implications of this new machine for the improvement of communication among scientists and economists everywhere are fairly obvious. In the first place, at a cost of only US$100 a roll including both the abstracts and the index entries for the number of entries noted above can be reproduced in positive copy for running in other selector machines. It would be impossible to buy the paper on which to type this information for anything like that sum. Moreover, the machine now in the Department of Agriculture Library is the first of its type ever to be constructed; undoubtedly newer machines will be built which will be even cheaper and faster and which will greatly increase the ease of making available everything that is needed for fully adequate communication, from both current and past recorded sources.

It should be borne in mind, however, that the machine alone will not solve any problems. It is merely a device for electronically matching the information coded into the film with the information sought, and electronically reproducing the desired information when it is located. The machine does not think, and it will probably create as many problems as it solves. It will create problems because it makes possible new orders of organization of knowledge, and the question then becomes not only one of merely putting into the machine whole indexing and abstracting journals, but rather one of creating tools at new intellectual levels to provide higher levels of service to scholarship. In determining what is really needed for the advancement of learning, the co-operation of scientists all over the world will be required.

Our organization of knowledge in the past, whether it be the collecting of books in libraries or the indexing of them, has been based primarily upon physical considerations, or at least has been limited in large measure by physical considerations. For example, the common method of organizing patents in a patent office is to put a copy of each patent under each major subject. Thus, the U. S. Patent Office, starting with approximately 3 million patents, places a copy of each patent in six places, on the average. This results in a file of some 18 million patents, which is so large and cumbersome that an excessive amount of time is required in going from place to place, and it is very difficult and costly to make a complete search. Furthermore, each page of each patent might have ten different ideas on it, and, if we are going to achieve organization of ideas by the arrangement of copies of physical objects (i.e., the patents), the file would probably be in the neighborhood of 200 million or more copies. The time required for running from

place to place would thus be so great that it might be cheaper to create the knowledge all over again than to search the collection.

Our indexes in the past have similarly been limited by their character as physical objects. Take *Chemical Abstracts* as an example, because it is one of the best scientific and indexing services ever provided. We find that its index, which costs more than one-third of the total cost of the service, gives only about five index entries per abstract. If we should attempt to bring out every subject, the index might be ten times as large, and it would probably be economically impossible of achievement, in its present form. On the other hand, even if we could afford to publish so thorough an index, the time required to search through it might become so great that it would be more economical of the chemist's time for him to repeat the experiments rather than to use literature.

At the present, a chemist must spend anywhere from two days to a week or more searching *Chemical Abstracts* alone before he undertakes an experiment. If he had to spend ten times as long handling the tremendous mass of index volumes which would result from indexing every idea, he would have very little time to spend in his laboratory.

Thus, it appears obvious that all of our organization of knowledge has been conditioned by physical considerations, both in terms of the bulk that we could afford to produce and the time spent by the user in going from place to place or in handling the great number of index volumes. In fact, in each case there has been a compromise between what we can afford to do as against what we should do in terms of communicating the knowledge contained in recorded form.

Since the electronic selector can run to a hundred thousand places faster than we can go to one, it substantially eliminates the searching time on the part of the scientist; and, since it can store 4,400 cubic feet of information, as normally filed, in one cubic foot of film, at very low cost, it should substantially eliminate the other physical considerations. Thus, for the first time, we can contemplate the possibility of organizing knowledge rather than organizing physical objects. However, in order to organize knowledge more intensively, we shall have to learn first what is really needed for the advancement of science or for the purposes of the operation of international organizations, and this will require a great deal of thought on the part of all subject specialists concerned. Thus, the possibility of improving communication through machines will become a probability only if we work together to determine what is needed so that we can tell the machine what to do.

Conclusions

It would appear that the problem of communication through the use of literature is one of the most vital problems facing any international organization or large national organization; that the printed record is one of the most important tools of communication; that effective use of the printed record is a two-fold use, requiring both the dissemination of the knowledge created by the organization through the medium of its own publication and the stimulation by the organization of the flow of knowledge useful to the purposes for which it exists, regardless of the form in which this knowledge appears or the source of its issuance; that the point of view in studying effective use of the written record must be changed from that of building up collections of physical objects to the building up of techniques for communication; that, in order to achieve practical solutions to the problems of two-way communication of the *knowledge contained in the written record* rather than accessibility of physical objects as such, greater thought must be given by the specialists in all disciplines to what it is they really need for the advancement of science; and, finally, that new tools are now at hand which have possibilities for improvement of communication. These machines cannot achieve any significant advance in the organization of knowledge, however, until our thinking has progressed far enough to enable us to tell the machines what we really want them to do.

FAO has a vital concern in the improvement of communication. It should work actively and closely with all national and international bodies in determining what is needed to overcome all barriers to the free flow of knowledge and in developing new mechanisms for the communication of knowledge in order to raise the level of research by dissemination of knowledge on the production, consumption, and utilization of agricultural commodities.

Personalities

Susilo Hardjo Prakoso has been appointed Head of the Forest Service of the Republic of Indonesia. He succeeds J. Fokkinga, who remains as an adviser.

The U. S. Secretary of Agriculture recently presented a Distinguished Service Award to Lyle F. Watts, Chief of the Forest Service, for his effective leadership in advancing the conservation of forest resources, both in the United States and internationally. A Superior Service Award has been presented to Reed W. Bailey, Director of Intermountain Forest and Range Experiment Station, Ogden, Utah, for creative thinking and dynamic leadership in research in watershed management, especially in the fields of rangeland rehabilitation and flood and erosion control.

Lord Robinson has been reappointed Chairman of the Forestry Commission of the United Kingdom; Lord Radnor and J. M. Bannerman have been reappointed to membership, and Professor John Walton has been appointed as a new member. Sir Samuel Strang Steel, who has been a Forestry Commissioner since 1932, and Sir William Taylor, who has been a member of the Commission since 1919 and who was recently knighted for his services to forestry, have retired.

Sir Gerald Lenanton, Deputy Chairman, was recently elected to succeed T. A. Storey as Chairman of the Timber Development Association, Ltd., in Great Britain. Sir Gerald, who was knighted in 1946, was Deputy Timber Controller from 1939 to 1941 and Controller-General, North German Timber Control, 1946-47. He is also Chairman of the Timber Agents and Brokers Association.

The death of Gaston Delevoy, one of the great specialists on the Belgian Congo, has been announced. M. Delevoy spent a great part of his life in the Congo, and his best-known work is the massive *Woods of the Katanga*. For some years he was Director of the Belgian Forest Research Station at Groenendael, and after his retirement from this post he remained technical consultant to the special Katanga Committee. His death, at the age of sixty-five, came as the result of an accident suffered in the course of a mission for this Committee.

Forest Research and Education in India

By C. R. RANGANATHAN
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The Forest Institute Estate at Dehra Dun

IN INDIA forest research and forest education are centralized in one large institution known as the Forest Research Institute and Colleges. This institution stands on 1,100 acres of land four miles west of Dehra Dun at the foot of the Himalayas. The estate, called New Forest, is a detached residential colony in which most of the workers of the Institute live, and it has a school and a hospital. A demonstration forest, an extensive arboretum, and a botanical garden comprise more than half the area of the estate. The branches dealing with forest research proper, the administrative offices, the herbarium, the museums, the Central Library, the Convocation Hall, and the Indian Forest College for training forest officers are all housed in a vast and imposing main building, while the laboratories, workshops, and pilot plants connected with forest products research occupy a number of separate buildings scattered over the estate. The estate itself enjoys the legal status of a "reserved forest" under the Indian Forest Act and is under the management of the Central Silviculturist.

The grouping of forest research, forest products research, and forest education for both officers and rangers in one central institution is not so much the result of a deliberate plan as of historical growth. The combination of educational and varied research functions, such as are discharged by the Indian Forest Research Institute, is perhaps a unique arrangement. It gives the Institute the character and atmosphere of a Forest University—an effect which is sustained and enhanced by the fact that the Institute stands in a small detached township of its own. It has been said that the branches dealing with forest products research, which have expanded enormously in recent years, really make up an institute within an institute. There are undoubtedly many advantages in thus centralizing under one roof all research and educational activities connected with Indian forestry. However, it is probable that if the Government of India were planning the setting up *de novo* of an institute for forest products research, the location chosen might be a timber-using industrial center, such as Bombay or Calcutta.

Historical Growth and Development

The present Forest Research Institute and Colleges are outgrowths of a Forest School for training rangers and foresters established at Dehra Dun in 1878 by the then local government, the Government of the North-West Provinces. This school was transferred to the Government of India in 1884 and named the Imperial Forest College. The first research post (properly so called) to be created was that of Forest Entomologist in 1900. The Forest Research Institute as such came into being in 1906, as an adjunct to the Imperial Forest College and was historically the second of the central research institutes set up by the Government of India, the Indian Agricultural Research Institute having already been started in 1901. The Forest Research Institute started with the following branches: Silviculture, Economics, Botany, Entomology, and Chemistry. The Economics branch, together with the Chemistry branch, dealt with all aspects of forest products research, while the other branches were (and are) mainly concerned with the biological aspects of forestry. A considerable advance in the organization of the Economics branch was made in 1921-22, when it was expanded to include well-equipped sections of Timber Testing, Wood Working, Wood Preservation, Wood Seasoning, and Paper and Pulp, as well as the service units of Wood Workshops and Mechanical Engineer shops. A section of Wood Technology dealing with the anatomy and identification of Indian timbers was added later.

A point of interest is that for 40 years prior to 1946 the heads of all the research branches have been forest officers drawn from the Indian Forest Service and from different provinces. The only exception is the Chemistry branch, which has always been in charge of

a nonservice officer. This fact — and the fact that nearly all Indian Forest Service Officers recruited since 1928, all officers of the Provincial Forest Services, and a predominant proportion of Forest Rangers throughout the country were trained at Dehra Dun— has helped to give the Forest Research Institute a position of prestige and importance in relation to the forest departments and forest services of India. It is generally regarded as the mecca of Indian forestry.

The functions of the Forest Research Institute now extend only to India as constituted at the partition in 1947. Previous to that they had extended to what is now India and Pakistan; earlier still they had extended to Burma until that country separated from India in 1937, through Burma still continues to subscribe to and utilize the services of the Institute's research facilities.

Forestry Education

Forest Colleges—Training Courses in Forestry

As has been mentioned, a college for training forest rangers was started at Dehra Dun in 1878. This has continued to function regularly, except for a break of two years in 1933 and 1934, when the need for economy during the then current trade depression caused provinces to suspend recruitment of professional staff. For over 30 years the two-year ranger course was the highest professional forestry training that could be had in India, as direct recruitment to the higher (gazetted) posts was confined to Europeans who had received their training in Germany, France, or England. In 1912, it was decided to open recruitment for the Provincial Gazetted Services to Indians. The Forest Research Institute had expanded considerably since its inception, and moved into new quarters in Chandbagh which were completed in 1914. The development of the Institute made it possible to establish a professional forestry course of a high standard for officers; such a course, known as the Provincial Forestry Course, was started in 1912. Although of the same duration as the Ranger Course (two years), it was of a higher standard, only graduates in science with a good university record being eligible for it.

As a result of a great change in general pol[illegible] lowing World War I, the Indian Forest Service w[illegible] rapidly and progressively Indianized after 1920. Th[illegible] first groups of Indians admitted to that service wer[illegible] trained in British universities. In 1926 it was d[illegible] cided to train probationers for the Indian Forest Service at Dehra Dun. The forests of India had be[illegible] under professional management for some 50 years and it was believed that the practice and principles of scientific forestry could be adequately demonstrated to the students in Indian forests. The Provincial Forest Service Course was closed, as under the new conditions it was believed that it would no longer be required. The new Indian Forest Service Course was, however, fated to be a short-lived one. In 1932, owing partly to over-recruitment in 1918-22, partly to the world trade slump, and partly to the uncertain political conditions due to the impending reforms, the demand for trained forest officers had shrunk almost to the vanishing point, and the new course was terminated, with the result that for six years there was no advanced forestry training in the country. The Indian Forest College was started in 1938 to train personnel for the gazetted forest services in the provinces and states and has since been working steadily. By this time the former Indian Forest and Provincial Forest Services had been amalgamated into one gazetted service recruited on a provincial basis.

Progressively increasing demands have been made on the capacity of the Indian Forest College since the end of the last war, largely as a result of postwar expansion schemes. These demands were met by doubling the number of classes taken each year in the two colleges, but this could not be done indefinitely without jeopardizing the efficiency of the instruction. Consequently the Government of India decided in 1948 to take over the Madras Forest College at Coimbatore and to run it as a Central Government institution under the auspices of the Forest Research Institute. That college was originally an institution of the Madras Government, designed for training rangers. It has now been expanded and equipped so as to train, like the Colleges at Dehra Dun, 30 forest officers and 70 rangers annually.

As implied in the foregoing paragraphs, forestry training in India is a function of the Central Govern-

The Timber Museum, displaying Indian timbers, their characteristics and utilization.

The Botanical Herbarium, containing one of the finest plant collections in the East.

Photographs by courtesy of the Forest Research Institute, Dehra Dun, India.

ment and is, as a rule, given to men selected for service in the forest departments. In India forestry is not taught in any university. There is, however, a proposal to affiliate the existing forestry courses at Dehra Dun to Delhi University. There are many advantages in central control of professional forestry education in a country like India. The system of equating the number of youths trained in forestry annually to the requirements of the public service has worked well in the past. In India conditions do not yet offer scope for employment of forestry-trained men in private forests or in industry.

Forest Research

Silvicultural Research

The Silviculture branch, which is one of the oldest in the Institute, deals with all aspects of silvicultural research, including forest management and forest mensuration. It maintains close relations with provincial silvicultural research officers, supplying them with technical assistance, co-ordinating the results of research, and acting as a clearing house for technical information from all over the world. The publications of this branch are numerous, the most outstanding being Troup's *Silviculture of Indian Trees*—a monumental work embodying the results of research at the Forest Research Institute and all over the country over an extended period—Champion's *Forest Types of India*, Champion and Trevor's *Manual of Indian Silviculture*, the *Statistical Manual*, and the *Experimental Manual*. The silvicultural techniques adopted throughout India are, to a large extent, based on research work done or directed by the Silviculture branch.

The program of silvicultural research is outlined by quinquennial Silvicultural Conferences held at the Institute, which are attended by provincial silviculturists and senior forest officers from the entire country.

While tree and crop measurements are carried out by the branch in a large number of sample plots in the provinces, experimental studies relating to seed tests, nursery practice, phenology, exotic species, and effects of heredity are conducted in the Institute's own demonstration area and experimental plantations.

The ledger files of the branch, which are carefully maintained, are a mine of information which has only been partially worked out. An important feature of the branch is its large photographic collection covering all aspects of Indian forestry. The photographs illustrating this article are from that collection.

The Silvicultural branch includes an Ecology section and a Soil Science section.

Studies in Systematic Botany—The Herbarium

The Botany branch comprises the sections of Botany and Mycology. The Botany section is much the older of the two and has produced numerous publications, among which are *Flora of Bihar and Orissa*, the revised *Forest Flora of the Punjab*, the *Flora of the Andamans*, the *Grasses of the United Provinces*, and Vol. V of the *Flora of Assam*, dealing with the *Graminae*.

An excellent herbarium attached to this branch is now estimated to contain over a quarter-million leaves. It is especially rich in grasses and is recognized as among the best in the East. It includes 1,200 irreplaceable type or co-type specimens representing new genera and species. In it are incorporated collections dating back to 1816 and those of Royle, Falconer, Griffith, Helfer, Wight, Stocks, Dalzell, T. Thomson, and others. Among the more recent collections are those of Brandis, Lace, Gamble, Duthie, Haines, Parker, Parkinson, Bor, Stewart, Mooney, and Raizada. With the help of the herbarium, the Botany branch provides an authoritative technical service to forest officers and botanists in the correct identification of plants.

The branch maintains a botanical garden, while the extensive grounds of the estate constitute a large arboretum which has been enriched by successive introductions of new plants.

Investigations in Tree and Crop Pathology

Although mycological work was started as early as 1911, systematic study of pathogenic fungi was not

taken up intensively till 1927, when a Mycology section was formed with a fully qualified mycologist at its head. Investigations of rusts on *Pinus longifolia, Pinus excelsa,* deodar, spruce, and fir were undertaken, and their host-parasite relationship with stem and needle rusts has been established and remedial measures suggested. The fungal diseases of sal (*Shorea robusta*) have been studied and a great deal of work has been done on wood-rotting fungi in general. The Mycology section collaborates with the Wood Preservation section in toxicity tests on treated wood.

Insect Pests and Their Control—Insect Collection

The Forest Entomology branch ranks with the Silviculture branch as among the oldest research branches in the Institute. The first Forest Entomologist (then known as Forest Zoologist) was E. P. Stebbing (1906-1909), who is now Professor of Forestry in Edinburgh University. His book, *Indian Forest Insects,* was the first major contribution to forest entomology in India. He was followed in 1911 by A. D. Imms, who laid the foundations of the reference collection of insects, which is one of the finest in the East. It contains over 17,000 authentically identified species, carefully preserved, duly labeled, and entered in card indexes and in ledger files. Great advances were made during the long tenure of C. F. C. Beeson as Forest Entomologist, and control measures for numerous insect pests were evolved and prescribed. These include control of the tom shoot borer (*Hypsipyla robusta*), the sal borer (*Hoplocerambyx spinicornis*), and the teak defoliators (*Hyblaea puera* and *Hapalia machaeralis*). Intensive work on the vector of the spike disease of sandal (*Santalum album*) has been done. The results of the accumulated research work of the branch were published in 1941 in Beeson's *Forest Insects.* The insect pests of felled bamboos and timber have also received considerable attention.

Forest Products Research

The foundations of timber research in India were laid by R. S. Pearson, who later became Director of the Forest Products Research Laboratory at Princes Risborough, England. Working with inadequate equipment and under difficult conditions, Pearson collected a mass of information regarding the preservative treatment, seasoning, and strength of Indian timbers. The large Utilization branch which he built up and guided for many years has now been split up into Wood Technology, Wood Working and Timber Mechanics, Wood Preservation and Composite Wood, Wood Seasoning, Chemistry and Minor Forest Products, and Cellulose and Paper branches.

Studies in Wood Anatomy and Structure

The Wood Technology branch—this name is perhaps a misnomer—deals with the anatomy and diagnostic features of Indian woods as well as the correlation between the technical properties of the timbers and their anatomical structure and rates of growth. The field of work is enormous as India has some 5,000 timber species. Between 700 and 800 timbers have already been studied in detail, while a general examination has been made of a few hundred more.

One of the main functions of the branch—this was especially the case during the last war—is to discover Indian substitutes for foreign timbers for special uses when imports of the latter become difficult or impossible. A notable discovery was that of red cutch (*Acacia chundra*) as a substitute for lignum vitae (*Guaiacum officinale*) used in tail-shaft bearings of ships. Current investigations relate to studies on the conversion of sapwood into heartwood, the relation between anatomical structure and glue bonds, and the structure and identification of fossils of timbers. A revised and detailed publication on the timbers of the *Dipterocarpaceae, Malvaceae, Sterculiaceae, Tiliaceae, Guttiferae, Melioceae, Combretaceae, Verbenaceae,* and *Lauraceae* is under preparation.

A large and authoritative publication by Pearson and Brown, entitled *Commercial Timbers of India,* embodies the earlier results of work done in this and other branches.

The branch maintains an authentic collection of Indian timbers as well as a large collection of photomicrographs.

The Wood Working and Timber Mechanics branch comprises the service units of Wood Workshops, including a small sawmill and a well-equipped Mechanical Engineering workshop and a Timber Testing laboratory.

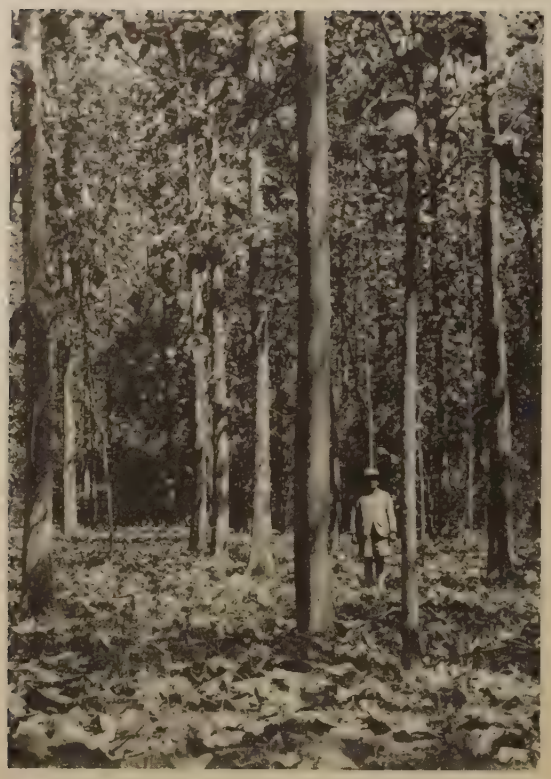
Testing Methods

The Timber Testing section was started in 1921 with the object of determining the mechanical and strength properties of Indian timbers on a scientific basis and in conformity with international standards. Such work had already been started at the Forest Products Laboratory in Madison, Wisconsin, U.S.A., and the methods adopted there were closely followed. More than a quarter-million tests have so far been made on a large number of Indian timbers, and engineering strength data have been prepared for about 150 species. Representative samples from a number of localities have been tested in the case of species like teak, sal (*Shorea robusta*), and shisham (*Dalbergia sissoo*) which have a wide distribution. By making use of the working-stress figures published by the Forest Research Institute, it is now possible to design timber structures using Indian woods with the same confidence as with structures based on steel and concrete and often with increased economy.

The laboratory has evolved wooden disk dowel joints which can be used cheaply in place of the iron straps, gussets, and bolts commonly employed in wooden structures.

Wood Preservation

The Wood Preservation and Composite Wood branch carries out research aimed at improving the service life and durability of timber by preservative treatment and at increasing the strength, stability, and technical qualities of timber by building up wood, whether as plywood, laminated wood, impregnated and compressed wood, or boards. Preservative treatment is of special importance in the tropical conditions of India, where, owing to attacks of white ants



Sample plot in a teak plantation formed in 1870.

and fungi, the natural durability of all but a small number of species such as teak, sal, and deodar is low. A number of preservatives have been tested and extensive studies have been made on coal-tar creosote as a wood preservative.

As a result of work done in the branch, an efficient water-soluble preservative known as Ascu (Greensalts in U.S.A.) has been developed. Preservatives have also been developed from cracked vegetable oil and chir pine (*Pinus longifolia*) resin.

The optimum treating conditions for over 1,000 species of Indian timbers have been determined, and a process of conditioning green sleepers has been evolved.

Investigations on the natural resistance to fire of over 50 timbers have been made; research into the laws of the burning of wood and fireproofing of wood has been undertaken. Work has also been done on the resistance of wood to corrosion.

Composite Wood

Various types of adhesives for wood assembly work and plywood have been evolved from the proteins of seed cakes, leaf proteins, aqueous-alcoholic extracts of cereal meals, urea formaldehyde condensates, tar acids, cashew-shell oil, etc. The suitability of various Indian timbers for commercial plywood is being tested, and investigations on the production of a variety of laminated, improved, and modified woods have been made with good results. The branch is now being equipped with a complete and modern plywood pilot plant.

The branch is engaged in developing a structural hard board from bamboos.

Wood-Seasoning Problems

The Wood Seasoning branch has studied the air-seasoning characteristics and determined the kiln-drying schedules of a large number of commercially important timbers. A survey has been made of the seasonal variations in the moisture content of wood when exposed to different climatic conditions. Research in some of the fundamental aspects of timber physics, such as the electrical properties of wood and the movement of moisture and heat in wood, has been undertaken, and much information has already been collected. The branch has done useful work in simplifying and standardizing drying kilns and in developing a cheap type of smoke kiln.

The study of the suitability of Indian woods for shuttles, bobbins, picking sticks, battery separators, pencils, etc., is one of the main lines of activity. Work is also being done on the steam-bending of wood.

Raw Materials for Cellulose and Paper

The Cellulose and Paper branch undertakes fundamental and applied research on the utilization of forest resources and agricultural and industrial wastes for the production of pulp, paper, and cellulose. Work done in the branch is mainly responsible for the development of the paper industry in India, which uses bamboo and sabai (*Eulaliopsis binata*) as the raw materials. The use of these materials was made possible by the development at the Forest Research Institute of the fractional method of digestion for the production of easy bleaching pulps at economic cost by either the soda or sulphate process. Research in the branch has also led to the production of kraft paper from bamboo.

One of the main problems of the branch is to discover a suitable raw material for newsprint, which at present is not being made in the country. Spruce and silver fir, the recognized raw materials for the purpose, although available in India, occur at high elevations on the Himalayas and cannot be produced at factory sites at economic cost. Recent work done in the Institute on *Broussonetia papyrifera* has given encouraging results. It is believed that plantations of this fast-growing species can be raised in suitable localities and worked on short rotations for the production of pulpwood for newsprint.

The branch is being equipped with a modern United States paper machine.

The branch renders regular technical service to the paper industry in India by supplying information and training technicians. It maintains close liaison with the industry.

Utilization of Minor Forest Products

The Chemistry and Minor Forest Products branch carries on research in the utilization of all forest products other than timber. Out of a total flora of about 14,000 species in India, over 3,000 are in use as

sources of raw materials for various industries or for medicinal and other purposes. These products comprise essential oils, drugs, gums, mucilages, pectins, tans, oils, dyes, waxes, fibers, flosses, resins, etc. The field of work is enormous. The branch has played an active part in the establishment of the turpentine and rosin industry and in the production of santonin and ephedrine. More recent work has led to the production of a pectinaceous material from the seeds of *Tamarindus indica*, a waste product of the tamarind pulp industry. This is used as sizing in the textile industry in place of starch. A new source of natural camphor from a shrub has been discovered, and cultivation experiments are in progress.

Interesting work has also been done on soil stabilization through the addition of small quantities of vegetable matter.

Statistical Planning and Control

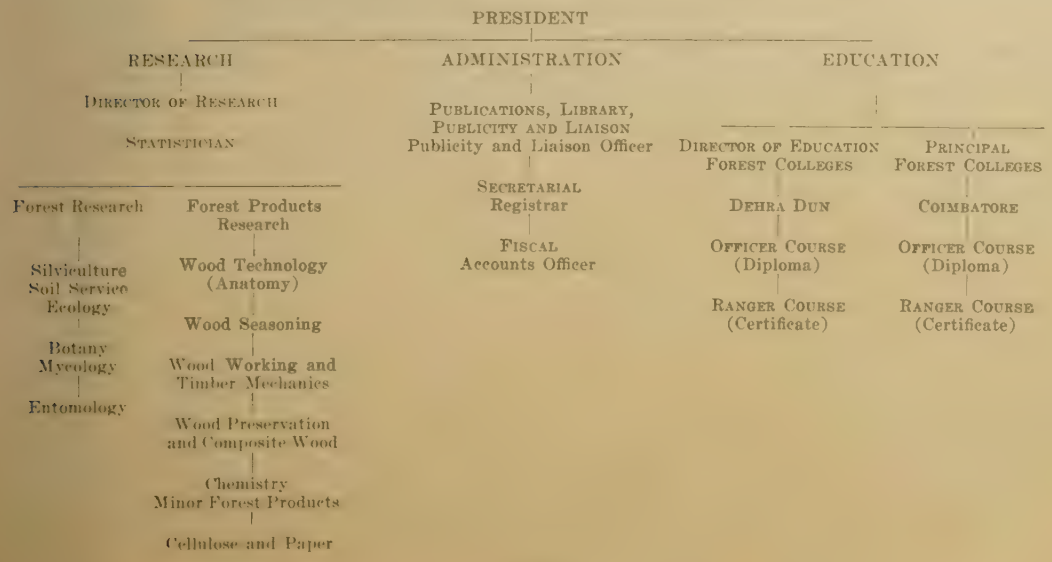
A new Statistical branch has recently been created. Its function is to advise on the layout of experiments and to carry out statistical analyses of the results obtained, not only at the Forest Research Institute but also in the provinces. The usefulness of the new branch has already begun to be felt.

Reorganization and Expansion Since World War II

The importance of forests and forest products in the economy of the country was forcibly emphasized by the experiences of the war years 1939-45. During this difficult period, not only did imports of forest products into India dwindle or cease, but India was called upon to export timber and other forest products to the Middle and Near East and to meet its greatly increased requirements from its own unaided resources. Great inroads were made on the forests of India. The Forest Research Institute was called in to find substitutes for many timbers in short supply and to help the war effort in numerous ways. The war showed clearly the great potential and actual usefulness of the Institute to the nation and high-lighted its deficiencies of equipment and personnel. When the war was over, a large reorganization scheme aiming at the extension and modernization of equipment and buildings and the strengthening of research personnel at an estimated capital cost of over Rs. 6,000,000 (about US$1,800,000) was sanctioned by the Government of India. The scheme is in process of implementation. Postwar shortages of structural materials, firewood, and other forest products have underlined the need for intensified research in forestry and forest products. But financial difficulties have now cropped up, and the progress of reorganization will have to be slowed down, although much has already been accomplished.

Despite the large output of publications by the Forest Research Institute and the close liaison that exists between it and the forest departments as well as the major industries using forest products, it has been felt that improved arrangements should be made for the quick dissemination of research findings and general forestry information, not only among those directly interested in forestry and forest industries but also among the general public. With this object in view, a new Publicity and Liaison branch has been set up. Its business is to organize publications and propaganda, take part in exhibitions, set up showrooms, convene conferences, receive and conduct visitors to the Institute, and in general to do everything possible to increase the technical service of the Institute to the people.

FOREST RESEARCH INSTITUTE AND COLLEGES, INDIA



Forest Soil Research In Finland

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THE key subjects for forest soil research are phenomena which, in one way or another, affect the fertility of the soil: what soil properties determine the fertility, how permanent this fertility is by nature, and what the possibilities are for improving the productivity of poor soils. The following is a brief report on what has so far been done in this field in Finland, where forest soil research has now been conducted for a quarter of a century.

In order to make the general trend and the objectives of this research work more comprehensible, it is best to explain at the outset some of the natural conditions and the characteristics of forestry and forest research in Finland.

First, many phenomena that are or have been foremost in forest soil research elsewhere are not found in Finland. For example, the competition between forest and heath, which is a problem in Denmark and northwest Germany, does not occur in Finland; neither does competition between forest and steppe, or between forest and prairie. Saline soils (like those in Hungary, for example), which are difficult to afforest, do not exist here, and soil erosion is unknown. Moreover, the forest soils in Finland are rich in mineral nutrients and have not been exhausted by such practices as the Central European use of forest litter, for example. Nor does the humus layer, as a rule, form a serious obstacle to natural forest regeneration, as in parts of Central Europe. Soil improvements of any kind on felling areas are rare in Finland.

When one considers that, in addition, the practical evaluation of forest soil quality in Finland is based exclusively on vegetation (the forest site types of Cajander), it is not surprising that both in practice and in forest research much less attention has been devoted to the soil itself than in many other countries. Thus, forest soil science has been a subject of higher forestry education in Finland for only four years. The author of this report does not know, therefore, why soil research was given so important a position at the Forest Research Institute that in 1918, when the Institute began its work, a third department for soil investigation was founded, in addition to the departments of silviculture and forest survey, each department headed by a professor. (The department for soil investigations started its work in 1923.)

Research on Soil Properties and Fertility

The general trend of forest soil research, as well as other forest research in Finland, has been fundamentally influenced by the forest type theory devised by Cajander. In his far-reaching program for forest soil research in Finland, Cajander ascribed the greatest importance to studies of the extent to which forest types are representative of natural site classes. Science cannot be content, he remarks, with merely stating a certain correlation between forest type and habitat, but must analyze more closely the biological value of the habitat. A reliable foundation for measures that aim at improved forest soil productivity can be laid only by examining the factors that determine site productivity. Nor did Cajander think it impossible that, by doing so, one might arrive at a purely climatic and pedological evaluation of site quality.

Chemical soil properties. The early forest soil investigations in Finland were concentrated principally upon *plant nutrients and soil acidity.* Chemical soil analyses (using cool, weak hydrochloric acid as solvent) showed that improved productivity of the forest type was correlated with distinctly increased lime and total nitrogen content. A correlation with potassium was not quite so clear, and the phosphoric acid content showed a decrease with improved habitat. Research on nitrogenous compounds, in particular, has shown that the ammoniac nitrogen content increases with improved forest type; nitrate nitrogen, on the other hand, is found mainly only in grass-herb forest soils. The total content of bacteria and microscopic fungi, too, has been demonstrated to increase with improved forest type, and the presence of so-called physiological bacteria groups (nitrifying, cellulose-decomposing, nitrogen-fixing, and other bacteria) varies in a certain proportion to the forest type. Furthermore, it has been demonstrated that the acidity of the humus layer decreases with improved forest type.

With regard to the results already mentioned, two principal facts should be noted: (1) In these investigations neither tree species nor physical soil characteristics have been taken into consideration, but only the forest type based on the lesser vegetation. (2) The results characterizing different forest types are average values derived from a huge amount of material;

with regard to individual soil characteristics, one and the same forest type may show considerable variations.

Textural soil properties. The influence of *grain size and superficial deposit* on soil productivity has been the subject of numerous investigations in different countries. In general, the correlation between soil properties in this respect and soil productivity has been proved to be much closer than in the case of chemical soil properties.

According to the Cajander theory, a forest type is not determined by soil texture (sand, loam, etc.). The same kind of soil may support widely varying forest types, and one and the same forest type may appear on very different soils. The forest type represents the integrated result of the biological total value of the site—the joint effect of all primary climatic and soil factors on the vegetation. Although this is generally the case, the statistical material obtained with regard to productive soils in Finland in connection with the second national forest survey (covering about 8,000 sample plots) shows a fairly clear correlation between soil texture and forest type.

The results are illustrated in Figures 1 and 2; the soils are divided into three textural classes according to the degree of coarseness: A = coarse-grained soils (sand, gravelly soil, etc.); B = medium-coarse soils (ordinary morainic soils); C = fine-textured soils (clay soils, etc.). The soil-forming areas (1, 2, etc.) according to which the research material is divided will be discussed later. In areas 3 and 4, the soil is 12 to 18 percent A-soil, 72 to 77 percent B-soil, and 10 to 11 percent C-soil.

With regard to the distribution of forest types according to different soils, it has been noted that with a change from coarse to fine soils under uniform climatic conditions or on the same kind of soil from northern Finland to southern Finland, the number of forest types decreases, i.e., a few types become dominant. Of the three leading species, the Scots pine (*Pinus sylvestris*) is dominant on coarser soils, the Norway spruce (*Picea abies*) and the birch on finer soils.

Within the same forest type, moreover, the growth of the trees may vary considerably according to the texture and grain size of the soil. In forests of Myrtillus and Vaccinium types, for example, the yield on very stony morainic soils is only 50 percent of that on a normal forest type. Certain special investigations have shown furthermore that the productivity of morainic soils intimately depends on the content of fine earth in the surface soil, if this content is calculated as a proportion of the soil as a whole (including also blocks, stones, etc.). In glaciofluvial deposits, on the other hand, the deeper soil layers, too, must be taken into consideration.

Soil-forming processes. The investigations already

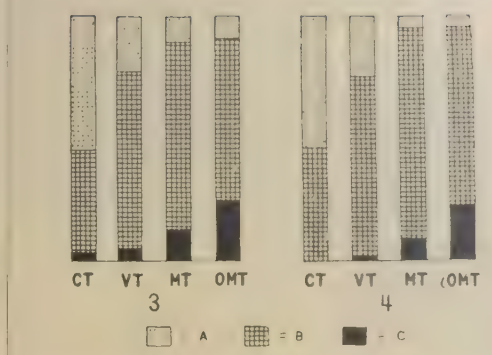

Fig. 1. Distribution of forest types among A, B, and C soils on soil-forming areas 3 and 4. CT = Calluna type, VT = Vaccinium type, MT = Myrtillus type, OMT = Oxalis-Myrtillus type.

described have been concerned with the chemical composition and the texture of the soil in forests of different forest types. Other research studies that should be mentioned are those on *soil-forming* processes.

Among the main soil-forming processes of the globe, the development of Podzol soil is dominant in Finland, where the climate is humid and the soil poor in lime. Due to climatic variations that occur even in Finland, the conditions for soil formation are not uniform all over the country. Leaching, moreover, is greatly dependent on soil texture and moisture conditions.

Only a few results of investigations on soil-forming will be mentioned here, and chiefly those that merit consideration from a practical point of view.

First, if the thickness of the A-horizon (of mineral soil) is taken as a measure of leaching strength, Finland may be divided into soil-forming areas as indicated in Figure 3. Of these, areas 1, 2, 3, and 4 represent geologically old soil, and 2a and 3a represent young soils. Among the former the soil is most weakly leached on area 4, somewhat more strongly on area 3, and most strongly on areas 1 and 2. Area 3a is most weakly leached. The variations—besides those due to the age of the soil—are explained by humidity variations.

In the sample plot investigations conducted in connection with the second national forest survey, the thickness (on productive soils) of the humus layer and the A-horizon was also measured. For the former, the classes < 2 cm., 2-4 cm., and > 4 cm. were used; for the A-horizon :-(= lacking or very weak), < 3 cm. and 3+ > cm. The results for different forest types

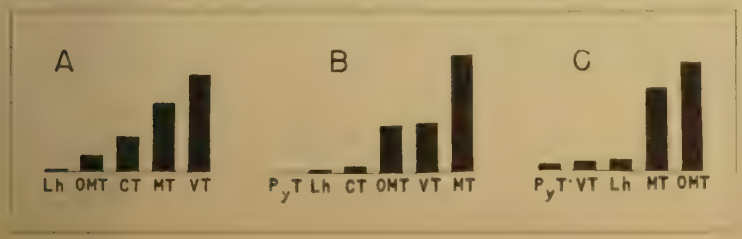

Fig. 2. Distribution of soils among forest types of soil-forming area 4. Lh = grass-herb forests, PyT = Pyrola type. (For other symbols, see Fig. 1.)

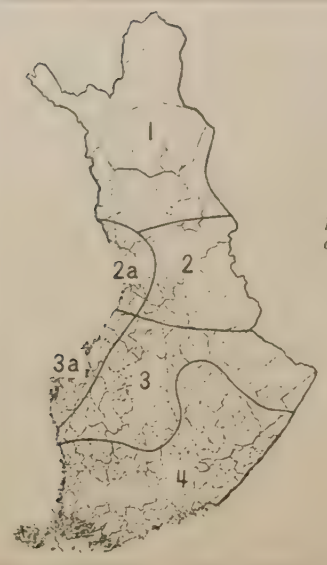

Fig. 3. Soil-forming areas in Finland.

from areas having produced the most abundant observation material are indicated in Figures 4 and 5. Productive soils in which the humus layer is considerably thicker than 4 cm. or the A-horizon considerably over 4-5 cm. are fairly scarce.

Why the soil profile varies with forest type in the way previously described has not yet been satisfactorily demonstrated, but most likely it is a question of the influence of soil texture (and moisture conditions).

In professional literature on soil science, tree species are generally regarded as an important, if not decisive, soil-forming factor. As appears from Figures 6 and 7, however, soil development (the thickness of humus layer and A-horizon) in Finland is fairly independent of tree species.

A clear correlation, on the other hand, exists between soil texture and soil profile. As is evident from Figures 8 and 9, the humus layer grows thicker and the A-horizon thinner when the soil becomes more fine-grained.

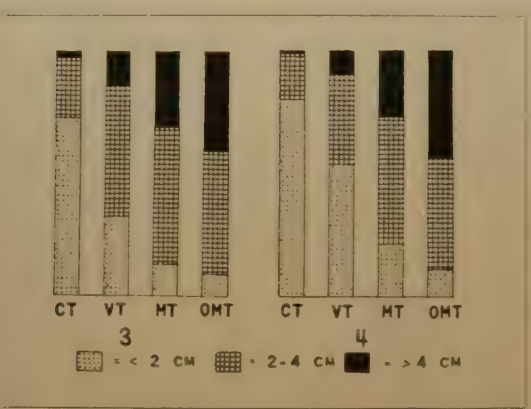

Fig. 4. Distribution of thickness classes (< 2 cm. etc.) of humus layer according to forest types on soil-forming areas 3 and 4.

It should be mentioned that these results refer to heath forests, the humus of which is *mor*, but that the so-called biological activity of the humus increases in the direction CT→OMT. Generally, when considering the relationship between tree species and humus layer, one should note that in Finland the forest soil is nearly everywhere covered with a more or less abundant ground vegetation and that the litter from this ground vegetation plays a very important role in the formation of the humus layer. Since the nature of the ground vegetation is closely dependent on the nature of the mineral soil and on moisture conditions, the primary characteristics of the mineral soil generally have a decisive influence on the humus-forming.

It may furthermore be mentioned in this connection that certain studies in Finland on the influence of the Siberian larch (*Larix sibirica*) compared with other tree species on the chemical, physical, and biological characteristics of the soil have not manifested distinct differences between various species. The larch seems

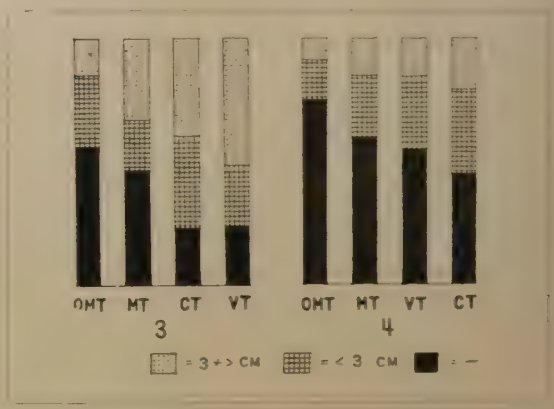

Fig. 5. Distribution of thickness classes (—, etc.), of A-horizon according to forest types on soil-forming areas 3 and 4.

to have a degrading rather than an improving effect on the soil.

Studies into the chemistry and physics of soil-forming have demonstrated in detail the chemical and physical changes of the mineral soil in dry, moist, and damp heath forests, as well as in grass-herb forests. These investigations have shed new light upon the following phenomena in particular:

(1) development of Podzol profile with growing age of soil;

(2) dependence of soil-forming on grain size of soil;

(3) mineralogical and chemical composition of the soil;

(4) leaching of calcium and other nutrients;

(5) soil-forming types.

The land-raising process, which in Finland has continued since the glacial period, offers an opportunity to trace the development of the soil profile from its

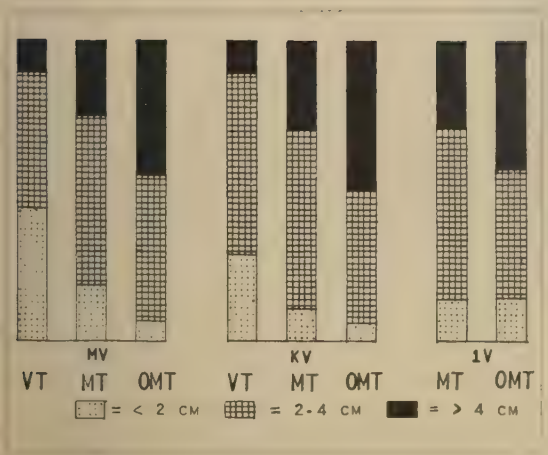

Fig. 6. Thickness of humus layer and tree species on soil-forming area 4; MV = pine-dominated, KV = stands dominated by spruce; LV = stands dominated by hardwood. Soil type, loamy moraine.

beginning to over 10,000 years of age. These investigations have made possible an analysis of the special importance of time as a soil-forming factor; they have shown that in some respects the development of the Podzol profile differs from earlier concepts insofar, at least, that the B-horizon grows from the bottom up. Chemical changes may be analytically demonstrated in soils of from 200 to 300 years of age, but the changes are nevertheless so slow that in ordinary forest soils a period of 1,000 to 1,500 years is needed for the profile to reach maturity.

As mentioned previously, there is a definite correlation between soil profile and geological superficial deposit. Mechanical soil analyses have clarified this correlation in detail and have proved it to be fairly constant. Leaching is strongest in soils coarse enough to be permeated by water, but yet fine-grained enough to maintain the amount of moisture necessary for weathering. In clay soils, leaching is weak or nonexistent; in moist sand, it is strongest. Hardpan is mainly found only in paludified coarse-grained soils; in ordinary productive soils it seldom occurs. Lodging of the finest particles to a greater depth is manifested only in clay soils.

With regard to mineralogical and chemical composition, the forest soils in Finland are rich in nutrients; poor sandy soils like those in northern Germany, on Jutland in Denmark, and elsewhere do not occur. However, calcium carbonate is found only in a few places in Finland in small amounts, and a considerable part of the silicate calcium is leached away. As a rule, the investigations have not been extended below a depth of 50 to 60 centimeters; but on the basis of certain observations it may be inferred that part of the calcium is leached away from a surface layer at least 1 meter in thickness, which likewise denotes that the soil is weathered to at least this depth. In addition, total analyses have demonstrated that, with a decrease in the size of the soil particles, the silicon content is reduced, whereas the content of calcium, aluminum, and iron is increased.

The author has divided the soil-forming types in Finland that are most important from the standpoint of forestry into two principal classes, the humus layer of the former being *mor* and that of the latter, *mu*. The main types in the former class are Podzol, Brown and Gray soils; those of the latter class are Brown and Gray soils.

Among the subtypes of the Podzol soil the most important are iron Podzol and humus Podzol, the former dominant in ordinary productive forest soils, the latter in moist and wet soils. Morphologically these types differ from each other particularly in that the B-horizon of the iron Podzol is reddish or brown, whereas that of the humus Podzol is chocolate-brown or almost black (a result of abundant humus). Gray soil is the soil-forming type of clay. Brown soil occurs in various types of forests; mull-brown soil, however, only in grass-herb forests. The last-mentioned type may be considered as a northern variety of the Central European Brown soil (Ramann).

Research on Stability of Soil Fertility

A question of vital importance, not only from the standpoint of forestry but with regard to land utilization in general, is *the regional variation in soil fertility* and its causes. Closely related to this problem is the question of the stability of soil fertility.

According to information on the occurrence of forest (and swamp) types and so-called exacting plant species, Finland is divided into the fertility areas indicated in Figure 10. The northern half of the country is considerably more barren than the southern half, but even in the southern part the fertility shows notable regional differences. The small, extremely fertile areas, or so-called grove concentrations, are not visible on the map.

The major fertility variations, such as the difference between the northern and southern halves of the country, are due to climatic differences. In similar climatic conditions, fertility differences are caused mainly by textural and topographical variations, viz., geological factors. To some extent, indeed, a greater abundance of fertile soils has been demonstrated in regions

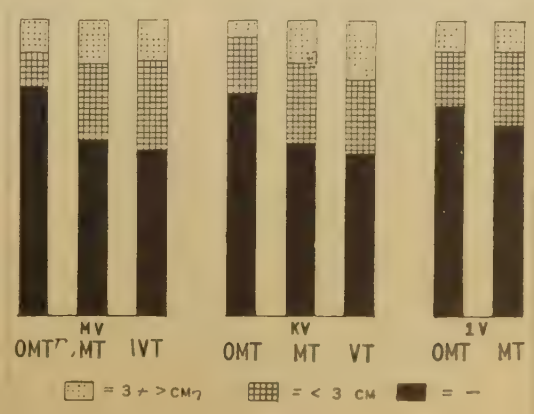

Fig. 7. Thickness of A-horizon and tree species on soil-forming area 4. (For symbols, see Fig. 6.)

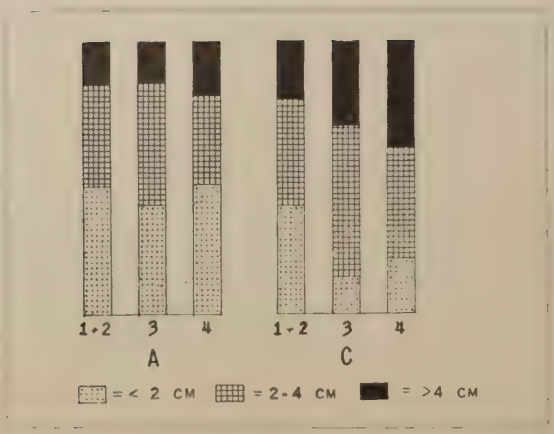

Fig. 8. Thickness of humus layer and soil texture on soil-forming areas 1 + 2, 3, and 4; A = coarse-grained soils, C = fine-grained soils.

where the bedrock has a higher content of basic kinds of rock than usual; however, these constituents form but a small proportion of the bedrock area. In Finland the bedrock for the most part is granitic primary rock.

The evaluation of forest soil quality is closely bound up with the question of the extent to which the quality classes are either static or dynamic. The more constant the quality classes are by nature, the slighter are the possibilities of changing soil productivity by silvicultural measures, for example.

From the standpoint of the stability of soil fertility in Finland, leaching merits particular attention. The general leaching of nutrients to a greater depth means a continuous exhaustion of the soil. Simultaneously, the soil acidity increases and the litter decomposition is delayed. These changes are so slow, however, that they need not be considered in practical quality classifications and yield calculations.

In a country like Finland, where most of the forest soils have been exposed to several fires in the course of time, the effect of fire on productivity represents an additional problem of forest soil science. Though no special investigations on this problem have been conducted, the general impression seems to be that, at least in dry heath forests, fires have had an exhausting effect on the soil. Cajander, for example, mentions that a Vaccinium type, and even a Myrtillus type, may for some time support a ground vegetation which does not noticeably deviate from that of the Calluna type, and that in certain cases a Vaccinium type may permanently change into a Calluna type. In spite of these and certain other vegetation changes, fires probably seldom cause a permanent deterioration of the general soil quality. The forest regeneration capacity of the soil is in most cases improved by fires, but in this respect, too, the effect is of short duration. It appears that on extremely dry sands, fire may cause a more lasting deterioration of the regeneration capacity.

An effect in many respects resembling that of forest fires was brought about by a primitive form of cultivation, formerly quite common in Finland, the so-called "burning over." Since, in this case, the soil was to some extent cultivated too, and one or several crops were harvested, the changes in the soil were greater and more lasting than those caused by forest fires. As yet, at least, there is no evidence that cultivation by "burning over" has caused any practically noteworthy and durable changes in the fertility conditions of Finnish forest soils.

All told, the forest-soil quality in Finland may be considered as fairly constant and practically static. This does not exclude the possibility of changes of the site quality caused by climatic factors.

It should be noted that the investigations referred to in this report have not applied to *the paludification of forest soils.* Some idea of the importance of this process may be inferred from the fact that swamps form about one-third of the whole land area in Finland and that the major part of the present-day swamps was once firm or dry forest land. However, the paludification of forest soils, too, is a relatively slow process and nowadays it is probably even slower than before.

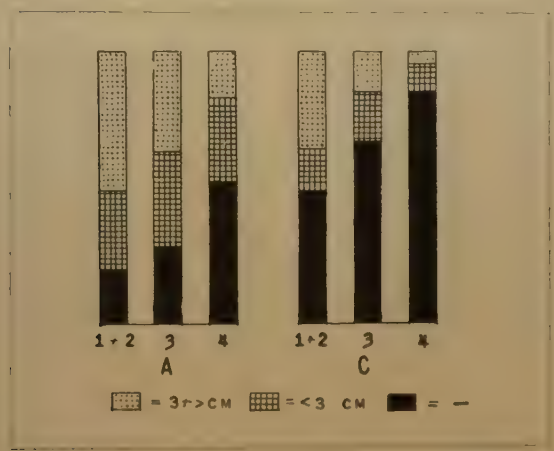

Fig. 9. Thickness of A-horizon and soil texture. (Symbols as in Fig. 8.)

Other Investigations

The most important further research is that pertaining to the chemical composition of needles and leaves, litter production, and so-called root competition. These investigations are unfinished, as yet, but it has been demonstrated that the composition of the ash and N-content of needles and leaves is dependent on the forest type as well as on the tree species. The picture of the useful nutrients of the soils thus obtained corresponds in its main features to that obtained by the chemical soil analyses previously mentioned. The nature and significance of root competition have been elucidated in studies on natural forest regeneration and the growth and yield of naturally normal stands, and also by greenhouse experiments and various root investigations.

Results of Forest Soil Research to Date

The main results to date of forest soil research in Finland, as well as their practical significance, are briefly the following:

In climatically, topographically, and otherwise similar conditions, a more or less clear correlation exists between forest types and those soil properties that are most important from the standpoint of soil fertility. This correlation, in turn, proves that the forest types represent natural site classes. It does not alone, however, decide the question of the adaptation of forest types as a means for practical evaluation of forest sites.

As to their mineralogical composition, the forest soils in Finland are comparatively rich in nutrients. Although leaching has occurred, and is continuing, the changes due to this process and to other causes are slow. The leaching has been weakest in clay soils and most intense in moist sands.

For the present, at least, the possibilities of improving the general fertility of forest soils are not great. Nor do silvicultural measures, such as thinnings, regeneration cuttings, etc., have any considerable effect in this respect. The natural regeneration of the forest, on the other hand, may be considerably advanced by suitable treatment of the soil surface (harrowing, burning, preparation by chemicals, and other devices).

Future Tasks for Forest Soil Research

As to the future tasks for forest soil research, certain unfinished lines of investigation have already been mentioned. Among these, those concerning the competition among trees for living space in the soil are specially suited for laying a theoretical basis for applied silviculture, i.e., according to habitat. Of other individual problems, those related to leaching and improvement of the soil regeneration capacity especially demand additional investigations. In order to clarify the former problem, lysimeter experiments should be arranged and, with the aid of river water analyses, the amount of nutrients that are leached away into the sea should be estimated.

Above all, the extent to which forest soil productivity is dependent on soil characteristics should be further investigated, particularly microbiological soil properties and processess which, as yet, have been comparatively little studied in Finland. An important question is the classification of site quality on glaciofluvial deposits, especially in the dry heath forests in northern Finland. The objective of all investigations belonging to this group is to develop, through forest types, a method of evaluating site quality on the basis of soil characteristics.

The objectives of forest soil research vary in different countries according to differences in natural and economic conditions. There are, however, problems that are common to all countries noted for forestry, and scientists from different countries may benefit from co-operation on the solution of these. Among the subjects previously mentioned for forest soil research in Finland, the following seem in particular to belong to this category:

(1) evaluation of site quality through soil investigations;
(2) stability of soil fertility;
(3) competition among the trees of a stand for living space in the soil.

Fig. 10. Regional fertility variation of sites in Finland. The most fertile regions are presented in black, the poorest ones in white.

Commodity Reports

Softwood Lumber

THE 1949 supply-demand situation in softwood lumber can be described as one of "temporary stabilization," but no such generalization can tell the whole story. Trade and consumption have tended to become increasingly regional. For example, only 10 percent of Europe's softwood lumber exports went to non-European markets in 1949, as compared with 17 percent in 1947. Similarly, the quantity of softwood lumber shipped from Canada and the United States to other markets dropped from 74 percent of total exports in 1947 to 47 percent in 1949. Although the Soviet Union showed more activity on the export market in 1949 than in the earlier postwar years, this did not suffice to alter the picture in any marked way.

In Europe, increased supplies were in line with effective demand in a number of countries and suggested an over-all balance. In the United Kingdom and some other importing countries, however, consumption is limited by factors which cannot be regarded as normal. One of the most important importers, Germany, is only now appearing among the list of purchasers. On the other hand, even with the impetus given to production for export by a firm or rising trend in prices, the capacity of the Scandinavian and Eastern European exporting countries is limited. In the long run, therefore, a balance between supplies and desired consumption levels in Europe obviously cannot be achieved without considerable supplies from the Soviet Union and at least marginal shipments from North America and eventually South America. Present imports from dollar sources are facilitated artificially, i.e., with dollar credits or grants. While Russian lumber, although considered to be of very high quality, is by no means irreplaceable, substitutes for some North American dimensions would be difficult to find. Of the total amount of dollars for which the Economic Co-operation Administration (ECA) had issued procurement authorizations through November 1949 ($7,600 million), only a little over 1 percent ($108.8 million) was authorized for imports of lumber and lumber products. The 1950 program for countries coming under the European Recovery Program (ERP) or Marshall Plan provides for a decrease in imports from the United States and Canada.

The strengthened position of Northern European lumber exporters, on the one hand, and the obvious hesitation of the United Kingdom to meet their price demands, on the other, led to an unusual opening of the 1950 export market in Europe, with relatively slow British purchasing activity. Even after the conclusion of an important contract with the U.S.S.R., a certain gap exists between supplies so far contracted for by the United Kingdom and estimated requirements for the whole of 1950. It may be, however, that the level at which softwood lumber prices in Europe had settled down by the beginning of the second quarter of 1950 would be attractive for Eastern European countries. The export of Brazilian lumber to the United Kingdom is an interesting feature of the 1950 lumber trade.

In Canada and the United States during the last two years there has been a strong domestic demand for softwood lumber, due to increased building activity and a high level of industrial production, which has resulted in relatively satisfactory prices for lumber manufacturers. The United States has proved capable of absorbing an increasing proportion of Canada's export lumber supplies, and the inter-relationships between the markets in the two countries have tended to grow still closer.

The Canadian sawmill industry is dependent on export trade to the extent of 40 to 50 percent of its total output. In prewar times some 25 to 30 percent of these exports went to the United States, and roughly 45 to 55 percent to the United Kingdom. In 1948 and 1949, 63 to 65 percent was absorbed by the United States and only 23 percent by the United Kingdom. But as a too great dependency on any single outlet, which can be easily affected by general business fluctuations, involves obvious risks, the Canadian sawmill industry considers that ways and means must be found for maintaining and, where possible, increasing exports to traditional overseas markets.

The outlook for the rest of 1950 is viewed with optimism in both Canada and the United States, because construction activity promises to maintain present high levels. In view of an increasing demand anticipated for the second and third quarters of the year, there is even some possibility that supplies of lumber in the United States may prove inadequate.

The currency shortage has affected also the timber-importing countries of Latin America which have devalued their national currencies. No accurate infor-

mation is available as to the present supply-demand situation, but there seem to be indications of a slight recession in lumber trade. The major exporter in that region, Brazil, has not devalued its cruzeiro, and has consequently become less competitive on its foreign markets.

In Oceania and the Far East, the development in Australia seems to be marked by a strong demand for lumber. Domestic production and gradually increased imports are expected to satisfy the requirements. New Zealand's plans for utilization of its forest resources provide for a radical increase in softwood lumber output during the coming years, with resulting export availabilities of considerable volume. During the next decade the development in New Zealand may prove to be one of the most interesting events arising out of the modern forest policy of this region. The prospective export surpluses of New Zealand lumber can be of growing importance for countries in that deficit area.

The large potential market for softwoods in Japan shows no sign of opening in 1950.

Europe

Consumption

The figures reported to FAO by twenty European countries* indicate a 10 percent rise in lumber consumption as between 1947 and 1948. In 1949, consumption appears to have risen still further. On the basis of preliminary reports, the 1949 consumption figure for all Europe is estimated at about 7.5 million standards. As compared with a prewar average or "normal" figure of roughly 9.7 million standards, the volume still shows an over-all decrease. Last year's consumption levels, however, give a somewhat varying picture of "abnormality" in different countries.

Among the principal importing countries, the Netherlands, Belgium, and Italy experienced increased demand, balanced by ample supply.

In the *Netherlands* both construction activity and the packing industry absorbed increased quantities of timber. As supplies were adequate, price controls on timber were removed at the beginning of 1950. The Dutch timber merchants started a propaganda campaign to regain those fields in which substitute materials had been used during the period of shortages.

In *Belgium* the development in 1949 was somewhat similar to that in the Netherlands. Building activity exceeded the 1948 levels by more than 50 percent, and the level of industrial production was satisfactory. Nevertheless, consumption of sawn softwood apparently dropped below the 1948 volume. This has been attributed chiefly to increased use of substitutes in construction and to rationalization in the use of timber as building material, rather than to shortages in supplies.

Construction activity in *Italy* also gained momentum during 1949, particularly toward the end of the year, and demand for timber consequently rose. Adequate supplies gave a feeling of a transition to a more or less normal situation.

In the *United Kingdom*, softwood lumber consumption showed a tendency to stagnate at an "abnormal" level. Building activity, which is controlled by the Government, did not reach the 1948 level; but demand for timber for construction purposes as well as for packing uses continued strong. The softwood lumber market was stable, with some slight characteristics of a buyer's market, but the level of activities was low compared with prewar. U.K. consumption of softwood lumber in 1946 was about 1,100,000 standards, in 1947 about 1,000,000, in 1948 roughly 1,200,000. The 1949 figure was about the same as the 1948. This is considerably below the "austerity minimum" estimate for 1949 of some 1.5 million standards, made at the beginning of 1949 by a survey committee (Keith Price Committee) appointed to consider the probable requirements and supplies of timber and plywood for 1949-53. The country's prewar consumption of softwood (excluding sleepers and crossings) has been put at an average of some 2.4 million standards annually. According to the Economic Survey for 1950, issued by the Government, the level of housing construction will be restored from the figure of approximately 180,000 units to 200,000, which is estimated to require an additional supply of some 30,000 standards of softwood lumber.

In *France*, the rate of new building is reported to have quickened somewhat in 1949. In spite of this fact, and the fact that industrial production showed definite recovery, timber consumption in this country also seemed to have stagnated at a comparatively low level. In 1947 and 1948 annual consumption of sawn softwoods was about 780,000 standards. The low level of consumption was accompanied by increased use of substitute materials, and this situation is expected to continue.

In *Switzerland*, demand for timber showed a declining trend, particularly during the last months of 1949. This caused some alarm and it was noted that here, too, the low level of consumption was due to the use of substitutes in construction and for industrial purposes. Supplies were plentiful in relation to demand.

Austria's building activity is reported to have increased slightly in 1949. Demand for timber was steady, but the rising trend in prices curbed consumption. However, softwood lumber consumption in the whole country increased somewhat.

In the northern exporting countries, trends in domestic timber consumption during 1949 varied. In *Sweden*, increased building activity (4 percent above the 1948 level) and rising needs of the packing industry indicated that timber consumption was higher than during the previous year. In *Finland*, also, construction activity rose slightly (18 percent on the basis of total number of rooms), and presumably timber consumption increased somewhat. It is estimated that *Norway's* building industry absorbed about 325,000 standards in 1949. This represents an increase over the 1947 and 1948 figures of 282,000 and 288,000 standards respectively.

On the whole, while consumption in the United Kingdom and France was at a relatively low level, in a number of Western and Central European countries it was felt that timber consumption could and should be increased by limiting the use of substitute materials.

At the beginning of 1950 there was a slightly rising tendency in timber consumption in both exporting and importing countries.

*The principal countries not included in these estimates were Albania, Bulgaria, Romania, the Soviet Zone of Germany, and Spain.

Production

As a result of a favorable felling season in almost all producing countries during 1948/49, stabilized demand, and firm prices, European production of sawn softwood increased by roughly 600,000 standards or 9 percent in 1949, and reached approximately 7.5 million standards (see Table 1).

In all three Scandinavian countries, output of sawn softwood showed increases. These were attributable, in addition to the several reasons mentioned above, partly to a strong export drive and partly to diversion to sawmills of small dimension logs usually absorbed by the pulp industry.

In Central Europe, the proportionately greatest increase in production occurred in Austria, where softwood lumber production rose by 74 percent. Sawmilling activity was stepped up in France, Germany, and Switzerland, partly as a result of salvage operations necessitated by the Landes fires and bark beetle attacks in France and by insect attacks and drought in Germany and Switzerland.

In Sweden and Finland, to judge from reports so far available, sawlog fellings are expected to increase in 1949/50, while fellings of fuelwood and small size roundwood may decrease. Fellings in Norway may fall short of needs; sawn softwood imports may increase, therefore, during 1950.

In April 1950, in his opening statement to the sixth meeting of the ECE Timber Committee, the ECE Executive Secretary pointed out that information available did not permit a forecast of greatly increased production in 1950 in the European countries which are now supplying the market. On the contrary, a slight reduction from 1949 levels has been foreshadowed for the continent.

Exports

The trend in exports of sawn softwood during the last three years (1.4 million standards in 1947, 1.6 million in 1948, and 2.0 million in 1949) has been satisfactory and has lived up to the hopes formulated at the Marianske-Lazné Conference in 1947.

In 1948, Sweden and Finland exported an aggregate of over 1 million standards. In 1949 their joint exports were 1.26 million standards, or about 60 percent of all European exports. In both countries, and also in Norway, unstable pulp markets during the first half of 1949 stimulated an export drive on the timber market.

TABLE 1.—PRODUCTION AND TRADE IN SOFTWOOD LUMBER, 1948 AND 1949

Country	Production		Imports		Exports	
	1948	†1949	1948	†1949	1948	†1949
	(Thousand standards)					
EUROPE	‡6,070	‡6,670	‡1,770	‡2,150	‡1,610	‡2,040
Importing countries	‡2,540	‡2,880	‡1,730	‡2,120	‡220	‡200
Belgium	58	34	104	93	2	...
Denmark	62	75	144	153	—	...
France	[1]642	[1]633	150	94	58	63
Germany:						
Bizone	1,023	1,341	9	82	76	72
French Zone	249	[2]240	...		73	...
Greece	7	9	[3]38	[3]48	—	—
Ireland	6	6	30	58	—	...
Italy	153	170	72	157	—	...
Luxembourg	3	1	1	8	1	...
Netherlands	3	3	278	325	—	—
Switzerland	268	268	17	9	7	1
United Kingdom	[4]65	[4]65	883	1,095	3	...
Exporting countries	‡3,530	‡3,790	‡40	‡30	‡1,390	‡1,840
Austria	269	468	3	7	104	262
Czechoslovakia	[2,3,5]518	[2,3,5]496	...	...	[6]68	[6]24
Finland	810	850	...	...	488	605
Norway	[3]310	[3]330	16	10	10	15
Poland	561	...	...	...	37	85
Portugal	128	128	2	2	24	15
Romania	...	...	...	...	4	[6]26
Sweden	928	950	18	15	556	656
Yugoslavia	...	...	...	...	[3]101	154
U.S.S.R.	...	...	...	...	[6]55	[6]131
NORTH AND SOUTH AMERICA						
Brazil	376	...	1	...	202	...
Canada	2,980	2,917	11	18	1,170	1,066
United States	14,300	13,200	[7]841	[7]728	[8]240	[8]257
OTHER COUNTRIES						
Australia	101	...	[6]79	...	—	...
Japan	1,768	...	—	...	1	...
New Zealand	207	...	4	...	[6]11	...

†Preliminary.
‡Comparable totals for listed countries only.
. . . Data not available.
—Nil or negligible.
[1]Does not include lumber produced from imported German sawlogs.
[2]January-September only.
[3]Includes hardwoods.
[4]Does not include sawn pitwood or lumber produced from imported sawlogs.
[5]Includes sleepers.
[6]Estimated from reports of importing countries.
[7]Does not include imports of shingles.
[8]Does not include exports to possessions and territories.

In Central Europe, the most salient features were the slight reduction in exports from Western Germany and the 150-percent increase in Austrian exports.

While 1949 exports from Czechoslovakia dropped, those from Poland and Yugoslavia rose. One of the most important features in lumber trade was the doubling of U.S.S.R. exports over the 1948 figure; the volume of Russian export lumber received by importing countries, however, did not reach 10 percent of the corresponding 1937 figure (1.4 million standards).

Many contracts for shipments in 1950 from the Scandinavian countries were concluded very early. Together with a firm trend in prices, this is expected to stimulate increased export activity in these countries. At the April 1950 session of the ECE Timber Committee, Sweden announced that its maximum export prospects for 1950 would be about 625,000 standards.

By the third week of April 1950, Sweden was reported to have sold some 470,000 standards to markets other than the United Kingdom, an agreement on prices with the latter not having been reached. It was regarded as evident that the full quantity of 250,000 standards provided for in the trade agreement with the United Kingdom could not be secured from deliveries during the remaining part of the year. To date, only 23,500 standards of Swedish lumber have been sold to the United Kingdom, and contracts for a few additional thousands of standards have been made.

Finland cautiously indicated to the ECE Timber Committee 600,000 standards as its maximum export availability for the current year. At the beginning of February 1950, its contracts with the Netherlands, Belgium, Western Germany, Denmark, France, Ireland, and Egypt were three times larger than those of the corresponding period a year earlier. The agreement with the United Kingdom provides for delivery of 225,000 standards. As a result of the favorable start in shipments and the firm prices, it was believed that the 1949 total export volume of 605,000 standards might be surpassed.

Softwood lumber exports from Austria in 1950 are expected to be at or slightly above the 1949 volume. German exports are scheduled to drop to a comparatively low level in 1950 and to disappear by 1951. By the end of 1950, France will probably have disposed of the main part of its exportable sawn softwood made available by the Landes forest fire and the insect attacks.

Under an agreement with the United Kingdom, Yugoslavia is to ship 150,000 standards of sawn wood annually to Great Britain during 1950-54. It is reported that, by mid-May, the British Timber Control had contracted for 130,000 standards. Aggregate sawn softwood exports from Czechoslovakia, Romania, Yugoslavia, and Poland in both 1950 and 1951 have been estimated by the ECE Timber Committee at somewhere between 175,000 and 275,000 standards.

In June 1950, the British Timber Control made with the Timber Export Administration of the U. S. S. R. a contract which, according to preliminary information, provides for shipment of 153,000 standards of lumber during the current year to the United Kingdom from ports on the Arctic Ocean and the White Sea, from Leningrad, and from some Baltic and East German ports.

Total European export availabilities were estimated by the ECE Timber Committee at 1.9 to 2.3 million standards in 1950 and 1.8 to 2.2 million in 1951. In 1949, slightly more than 100,000 standards were shipped overseas.

Imports

Sawn softwood imports of European countries from European sources reached a total of 1.9 million standards in 1949, as compared with 1.4 million standards in 1948. Imports from overseas dropped from 360,000 standards in 1948 to about 280,000 standards in 1949.

The United Kingdom's imports totaled 1,095,000 standards. While greater than the 883,000 standards imported during 1948, this quantity was considered in trade circles quite inadequate, the figure being about one-half of 1937 imports. It should be noted that the increase in lumber imports was offset by a 590,000 m^3 decrease in sawlog imports (mainly from Germany), or enough logs to manufacture about 70,000 standards of lumber. British purchases from Finland, Sweden, Yugoslavia, Poland, Romania, and particularly the U.S.S.R., had increased considerably over 1948, whereas imports from Canada dropped from 264,000 standards in 1948 to 218,000 in 1949. Imports from the United States were negligible (29,000 standards), while imports from Germany totaled 89,000 standards.

Many other traditional importers of softwood lumber, particularly the Netherlands, Denmark, Ireland, and Italy, increased their imports during 1949. But Belgium, France, and Switzerland reduced theirs. It appears that Western Germany's imports reached a total of 82,000 standards (10,000 in 1948), made up of over 55,000 standards from Sweden, over 22,000 from Finland, and the rest from the United States.

It is believed that Germany will soon become a strong competitor to other buyers of Scandinavian lumber. In 1950, Western Germany, like Denmark, the Netherlands, and Belgium, entered the market for Swedish and Finnish lumber contracts at a very early stage. This "buying wave" has been attributed, among other factors, to general improvement in the economic conditions of the buying countries and, in some cases, to the abolition of government controls.

In the absence of U.S.S.R. export competition, and as a result of the devaluation of currencies and reduction of dollar imports, the dependence of European importers on Scandinavia for wood supplies seemed to become more pronounced during the first months of 1950. Traditionally the world's largest wood importer, the United Kingdom was, however, planning to implement its "austerity" import plan of 1.05 million standards by increasing imports from Poland, Yugoslavia, the U.S.S.R., and Brazil and maintaining purchases from dollar sources at the previous year's level, even if shipments from the Scandinavian countries, particularly Sweden, were to be curtailed. By the end of the first quarter of 1950, U.K. imports of sawn softwood had amounted to only 93,600 standards. This was 49,000 standards less than the first-quarter imports in 1949, and 87,000 standards less than those for the corresponding period in 1948. First-quarter shipments from Canada dropped from 25,800 standards in 1949 to 5,000 in 1950, those from Germany from 37,000 to 3,600, and those from the United States from 5,000 to less than 500 standards.

No shipments were forthcoming from Romania in the first three months of 1950, as against 5,500 standards in the corresponding period of 1949. It was later reported that, for 1950, the United Kingdom had contracted for 40,000 standards from Brazil and for some 155,000 standards from Canada and the United States, and 60,000 standards from France. To these quantities, the contracts for shipments under agreements made with Finland, Sweden, and Yugoslavia, totaling some 270,000 standards, had to be added. As a result of the contract made with the U.S.S.R., the supply situation of the United Kingdom was considerably improved.

Total European import requirements are expected to be at approximately the 1949 level of effective imports.

Prices

On the export market, softwood lumber prices, which had been more or less stable since the beginning of the second quarter of 1949, began to show an upward trend toward the end of the year. In the northern exporting countries, demand for higher export prices for lumber was motivated by the general rise in production costs caused by devaluation, the decrease in prices for pulpwood, and a decline in demand for sawmill waste. Sawmills in Scandinavia depend to some extent on the capacity of pulpmills to absorb and pay for sawmilling waste. The importance of this inter-relationship becomes evident if one considers that one month's stagnation in the Finnish sulphate mills would mean a reduced absorption of wood corresponding to the volume of waste arising from the manufacture of nearly 100,000 standards of sawn timber. In Sweden the basis of calculation is that about one-half of the timber used by sawmills is turned into waste. (More precisely, about 310 cubic feet of timber are required for producing 165 cubic feet or one standard of sawn lumber.)

On the other hand, brisk demand for lumber was stimulated by the lifting of regulations affecting private trade in a number of countries, such as the Netherlands, Denmark, and (from 1 April 1950) Ireland. In these and some other countries—for example, Belgium and Western Germany—importers were anxious to secure quantities of picked selections of first-class specifications at an early stage and were willing to meet Scandinavian price requirements.

As a result, prices for good qualities and favored dimensions of Scandinavian lumber went up. Opening prices in 1950 for 7″ red u/s battens in Belgium were £46 10s. to £50, f.o.b., per standard (in 1949, £46 to £47 10s.), and those for 7″ red u/s boards were £62 to £65 (in 1949, £57 to £60). Prices of 7″ red fifths battens, on the other hand, remained at about the same level as a year before, and those for 7″ red fifths boards dropped slightly. Dutch importers, competing with Belgian buyers, paid from £2 to £3 more per standard than a year earlier for good Finnish qualities. Denmark has included timber and lumber (with the exception of planed and dressed boards) in its list of commodities on which imports from ERP countries were "liberalized" as of 10 March 1950. It is applying this list also as regards importations from Finland, which is not a member of the ERP group. Consequently, prices for Swedish and Finnish timber in Denmark will no longer be fixed by agreements covering the whole year.

In February 1950 the British Timber Control came to an agreement with Finnish exporters on prices for the lower-quality groups IV, V, and VI, which are supposed to represent more than half of Finnish lumber exports to the United Kingdom. Prices for the higher groups were subject to further negotiations. The Finnish prices for 1950, thus fixed, showed the following increases over 1949 prices:

7″ Red Battens, F.O.B. Prices

U/S	1949	1950	Increase
Group IV	£40. 0.0	£44. 0.0	£4.0.0
Group V	£39. 5.0	£43. 5.0	£4.0.0
Group VI	£38.15.0	£42.15.0	£4.0.0
Fifths			
Group IV	£36.15.0	£39.10.0	£2.15.0
Group V	£36. 5.0	£39. 0.0	£2.15.0
Group VI	£36. 0.0	£38.15.0	£2.15.0

It is reported that from 15,000 to 20,000 standards of Finnish lumber belonging to the upper groups have been contracted to the United Kingdom at basic prices of £45 10s. for 7″ u/s redwood battens and £40 10s. for 7″ redwood fifths in group II, and 10s. less for group III, all net f.o.b. These prices show an increase of £4 10s. for u/s redwood battens and £3 5s. for redwood fifths.

By early April, Swedish exporters were reported to have sold to markets outside the United Kingdom at prices corresponding to a basis of £51 or more for 7″ u/s redwood battens net f.o.b. The tension between export prices and domestic prices having become too intensive, control of timber prices on the Swedish home market was abolished on 13 March.

Not until late April did the British Timber Control reach an agreement with an individual Swedish exporter on prices for a shipment of 23,500 standards. These prices, quoted c.i.f., showed an increase of £5 for u/s 7″ red battens and £3 for 7″ white battens, and of £4 to £5 more for red fifths. The contract was expected to be followed by further purchases of Swedish lumber, but by mid-May only very insignificant contracts had been made.

Yugoslavian prices for shipments to the United Kingdom in 1950 were reported to exceed the 1949 c.i.f. prices by £4 to £5 per standard.

The price basis for Brazilian Paraná pine contracted for by the United Kingdom is reported to be £53, f.o.b.

Although prices for lumber to be shipped to the United Kingdom, under the arrangement made with the U.S.S.R. in June 1950, are quoted partly on f.o.b. and partly on c.i.f. basis, and although the quality of Russian lumber and that of Northern European lumber are not entirely comparable, it is reported that, upon the whole, the U.S.S.R. prices show a strengthening trend somewhat similar to that of Scandinavian prices.

North America

Canada

Consumption

Consumption of lumber in 1949 was affected by unprecedented activity throughout the construction field. From preliminary figures, the total value of building and construction contracts awarded is reported to have reached Can$1,400 million as compared with $954 million for 1948.

The domestic demand for lumber in 1950 is expected to equal or even slightly exceed that of 1949. It is expected that financial assistance provided by the federal government will result in the construction of more housing units than in 1949 and that a similar upward trend can be foreseen for other categories of construction also.

Production

Production of softwood lumber in 1949 amounted roughly to 2.92 million standards declining by about 2 percent from the 1948 output of 2.98 million standards. Softwood production in British Columbia fell 4.2 percent from 1948 levels, and production of both softwoods and hardwoods in the other provinces (except Newfoundland) fell 6.8 percent.

The West Coast of North America suffered from unfavorable weather in January 1950, but production of softwood lumber in British Columbia recovered in February, and the first two months' total was only 4 percent lower in 1950 than in 1949. In the other provinces, except Newfoundland, total production for the first two months was 9 percent lower than in the preceding year. In all Canada, production during this period was 6 percent lower than in the corresponding period in 1949.

Trade

In 1949 softwood lumber exports, excluding shingles, amounted to approximately 1.07 million standards, or about 37 percent of total softwood production. The United States was the most important market, taking close to 670,000 standards, or 63 percent of the total; the United Kingdom took approximately 236,000 standards, or 22 percent of the total.

In the first quarter of 1950 Canada's softwood lumber exports, excluding shingles, rose to 288,000 standards, a 41-percent increase over the corresponding figure for 1949. Exports to the United States continued to increase, while shipments to the United Kingdom continued to decline.

The decline in all Canadian exports to the traditional United Kingdom market is viewed with some concern. Over 80 percent of these exports were financed from ECA funds during the last nine months of 1948, and nearly 50 percent in 1949. The scheduled tapering-off of dollar grants to ERP countries may thus have far-reaching consequences for Canada unless exports to the United States can be increased. As regards softwood lumber, an eventual decline in the United States demand for lumber could easily affect large segments of the Canadian sawmill industry. General plans are under elaboration by the Canadian Government to shift several hundred million dollars' worth of imports from the United States to European countries, primarily the United Kingdom. If these are carried out, they might lessen the repercussions of the termination of the European Recovery Program (by 1952) upon the sawmill industry of Canada.

United States of America

Consumption

Exceptionally favorable weather conditions permitted continuation throughout 1949 of the strong construction activity which had started during August and September. According to the Bureau of Labor Statistics, housing activity throughout the country was record-breaking during the fourth quarter of the year, resulting in a total of 1,019,000 new non-farm dwelling units started during 1949. When farm houses, prefabricated houses, trailers, and reconversions are added, the estimated total number of new dwelling units for 1949 will exceed 1,300,000, the greatest number on record for any single year. In terms of dollars, also, last year's construction activity was unprecedentedly high; the value of investments in new construction totaled $19.3 thousand million, private construction accounting for roughly $14 thousand million of this amount and public construction for the remainder.

The strong demand for lumber during the last part of 1949 brought total lumber consumption for the year to a relatively high level. Consumption of softwood lumber in 1949 is estimated at 14.0 million standards, which is very close to the 1947 figure and only 3 percent less than the 1948 figure of 14.4 million standards.

This demand continued also during the first months of the current year. In terms of dollar value, new construction during the first quarter of 1950 was 18 percent greater than during the corresponding 1949 period, and reached a new record for the quarter. Softwood consumption for the first three months of 1950 was estimated at 3.45 million standards, and the second-quarter's consumption was expected to reach 4.1 million standards.

Production

Softwood lumber production in 1949 amounted to approximately 13.2 million standards, about 8 percent less than the 1948 production of 14.3 million standards.

Severe weather conditions prevailed in many important softwood lumbering regions at the beginning of the year. But production rose considerably in the spring, and reached for the first quarter of 1950 an estimated quantity of 3.0 million standards, 6.4 percent over the figure for the corresponding volume in 1949. Second-quarter production in mills reporting to the National Lumber Manufacturers' Association was also above the 1949 levels as of early May.

However, neither favorable production nor heavy drain on mill stocks, which continued through the last quarter of 1949 and the first quarter of 1950, could keep pace with the increased demand. By the beginning of May, industry circles felt that signs of an impending shortage of lumber were already apparent. It was generally expected that during the summer demand would exceed supply.

Prices

As a result of the heavy demand, average composite prices of construction lumber steadily increased from August 1949 through January 1950. The development of softwood lumber prices is illustrated in Table 2.

TABLE 2.—SOFTWOOD LUMBER PRICE INDICES
(1939 = 100)

Period	Southern pine	Douglas fir	Western pine
1948—total year	345.0	375.8	338.0
1949—total year	305.3	341.8	329.1
1948—4th quarter	332.2	381.0	346.8
1949—3rd quarter	297.4	332.1	321.9
—4th quarter	311.0	328.0	319.6
1949—January	320.3	359.8	340.7
1950—January	314.6	330.9	323.8

SOURCE: U. S. Department of Commerce.

The upward trend in lumber prices continued through February and March 1950, with some items in short supply reaching a level entirely out of balance with the rest of the market. The setback in production on the West Coast was accompanied by unforeseen sustained demands. By the last week of March, average prices for Douglas fir were $53 and $55 per thousand board feet, or $10 higher than a year earlier. The rise in average prices of all construction lumber amounted to 4.4 percent during the first quarter of the year. Prices are not expected to level off until more air-dried stock becomes available later in the year.

As a result of the very active market at the turn of the year, the influence of Canadian price competition was not felt strongly. However, according to the West Coast Lumbermen's Association, lower wages, lower transportation costs, and the "profit margin" created by devaluation give British Columbia mills, competing with mills in Washington and Oregon, definite advantages which may add up to as much as $11.60 per thousand board feet. The import tariff in the United States is $1 per thousand board feet.

Exports

Softwood lumber exports, which declined during the first six months of 1949 as compared with the previous year, gained during the last half of the year. The volume of softwood lumber exports for the total year thus reached 257,000 standards as compared with 240,000 standards in 1948. Exports to the United Kingdom dropped 37 percent from the 1948 level and reached a total of only 29,000 standards. Shipments to the rest of the countries in the European Recovery Program group, however, increased slightly. Exports to areas outside the Western Hemisphere included considerable quantities for the Union of South Africa, Australia, and Korea.

During the first quarter of 1950, exports of softwood lumber dropped 36 percent below the corresponding figure in 1949, totaling only 38,000 standards.

Imports

Softwood lumber imports increased considerably during the last quarter of the year as compared with the three earlier quarters, the imports of Douglas fir and hemlock rising by 19 percent. Imports for the whole of 1949 totaled about 728,000 standards, which represents a decline of 13 percent from the 1948 figure of approximately 840,000 standards.

The strong demand prevailing during the first months of 1950 was reflected also in imports. Thus imports of softwood lumber for the first quarter of the year were 273,000 standards, an exceptionally high figure which was 35 percent above the imports during the corresponding months of 1948.

LATIN AMERICA

Brazil's lumber production from Paraná pine has for some time been limited to a level corresponding to some 30 percent of total sawmill capacity; thus in 1947-48, the authorized output of the more than 2,900 sawmills, with an aggregate capacity of 1,120,000 standards, was only 348,000 standards. According to theoretical estimates, domestic consumption could reach approximately 330,000 standards per year; in 1947 and 1948 it was about 220,000 and 180,000 standards respectively.

In the first half of 1949, the National Pine Institute limited Paraná pine production to 40 percent of capacity and continued the restriction prohibiting the erection of new sawmills in the pine areas. Some 80 percent of the output of third- and fourth-grade lumber and 20 percent of the first- and second-grade lumber is generally absorbed by the home market, the remainder being exported.

Exports of Brazilian softwood lumber totaled 202,000 standards in 1948. Traditionally, Argentina is by far the largest customer, with Uruguay taking much smaller quantities. In the first half of 1949, exports were reported to have declined to about half of those for the corresponding period of 1948, possibly as a result of Argentina's barter trade with Yugoslavia and Romania, which began in 1948. However, it is expected in trade circles that recent trade agreements with Argentina and Uruguay will improve the situation. As is mentioned elsewhere in this report, a sizable quantity of Brazilian lumber has been contracted by the United Kingdom in 1950 on a barter basis.

It is believed that the Brazilian pine region could increase export production to many times its present volume without depleting the forest resources.

Only minor quantities of softwood lumber are received in Central and South America from countries other than the United States, Canada, and Brazil. The position of softwood lumber importing countries was affected in 1949 by the currency situation which resulted in heavy curtailments of dollar imports. U.S. shipments of softwood lumber to Argentina declined from 13,000 standards in 1948 to 400 standards in 1949. Its exports to other Latin-American countries also declined, with the exception of shipments to Mexico and the relatively negligible shipments to Chile and Haiti, which showed a very slight increase.

Swedish exports of sawn and planed softwood to Central and South America increased from 1,500 standards in 1948 to 2,300 standards in 1949.

AFRICA

Preliminary unofficial figures on imports of sawn and planed softwoods into the Union of South Africa

show a decline from 128,000 standards in 1948 to 88,000 standards in 1949. Imports from the United States declined slightly, reaching a total of 29,000 standards as compared with 34,000 in 1948. Shipments from Canada dropped to 36,000 standards as compared with 47,000 in 1948, and those from Sweden declined to 12,000 as against 32,000 in the previous year. The Union of South Africa also received 3,000 standards of softwood from Brazil in 1948.

Total shipments of both North American and Scandinavian softwood lumber to other African markets showed a slight increase. Swedish shipments to Egypt and the Sudan, for example, were close to 17,000 standards as compared with approximately 15,000 in 1948.

Far East and Oceania

Japan, at one time the largest single buyer of American lumber, is estimated to need considerable quantities of imported lumber in addition to supplies made available by domestic production. However, means of financing large-scale lumber imports do not yet appear to be in sight.

Hong Kong imported in 1949 a total quantity of 50,000 standards of Douglas fir, China fir, and China pine lumber, and re-exported 1,600 standards.

Demand for timber in *Australia* has been quite high during the last few years, owing to lack of building during the war. Apparent consumption of softwood lumber has risen from 173,000 standards in 1947 to 180,000 in 1948 and 222,000 standards in 1949. Consumption is expected to increase slightly in 1950 and to reach in 1951 a total quantity of 242,000 standards.

To what extent the domestic sawmilling industry, and particularly the existing Australian forest resources, will be able to meet the future requirements of the rapidly increasing population of Australia is an unanswered question. Production of softwood lumber has shown a steady but relatively slow rising trend. From 99,000 standards in 1947 and 101,000 in 1948, it increased to 103,600 standards in 1949. Domestic production provided about 57 percent of total consumption in 1947 and about 47 percent in 1949. It is expected that production will rise slightly in 1950 (to about 104,100 standards) and again in 1951 (to about 105,500 standards). The steadily increasing gap between requirements and production has been met by imports, traditionally from North America, New Zealand, British Borneo, and the Scandinavian countries. In spite of a tariff preference, imports from Canada in 1948 fell below those from the United States, owing to more favorable f.o.b. prices quoted by the United States. A change in the Australian tariff schedule is reported, which imposes a 12.5 percent ad valorem duty on lumber imported from the United States but still leaves lumber imported from Canada duty free. This will undoubtedly affect the source of imports. According to U. S. statistics, exports of softwood lumber from the United States to Australia increased further in 1949, reaching 25,000 standards. Shipments from Sweden amounted to 25,000 standards.

In *New Zealand* the consumption of timber has reached a high level and is expected to increase, particularly if immigration continues. During the year ending 31 March 1949, apparent consumption of all lumber amounted to 239,000 standards, of which about 234,000 standards (98 percent) were softwood lumber. The New Zealand Director of Forestry estimates that, at the present rate, the annual domestic demand for sawn timber may be as high as 300,000 standards within the next fifteen years. During the years 1944-48 the number of sawmills in operation increased by 50 percent to a total of close to 700. In the year ending 31 March 1949, total lumber output reached an all-time record of 241,000 standards, of which 85,000 standards were exotic coniferous species. Indigenous species—mainly broadleaved, but including also some heavily exploited coniferous species—have supplied almost 70 percent of all sawn timber consumed within the country. It is strongly felt that the annual cut of those species must be drastically reduced and that, consequently, mills will be forced either to close down or to obtain supplies of exotic woods. It is believed that the exotics could by 1960 yield some 328,000 standards of lumber, of which about 250,000 standards would be absorbed by home consumption.

Exports of softwood sawn timber from New Zealand are becoming an important feature of trade in Oceania. From only 4,700 standards in 1947, the volume of softwood exports rose in 1948 to 10,900 standards. In 1949, exports of New Zealand exotic softwoods amounted to 11,100 standards, and they are expected to increase somewhat over this figure in 1950. For the years 1951-54 an increase to 35,000 standards is scheduled, and, when the National Integrated Unit comes into operation, by 1954 or 1955, a maximum of 70,000 standards should be available for export. By that time, shipments to other markets than Australia, which now purchases the bulk of New Zealand's surplus of sawn softwoods, could reach a considerable quantity.

Errata

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Column 1, paragraph 5, line 3, substitute: Norway plans to build a new chemical pulp mill which will replace two old mills. The total annual capacity, therefore, will not be increased, nor is the consumption of pulpwood expected to increase.

Page 75

The title of the chart should read: U.S. Share of World Newsprint Supplies. Attention is also drawn to an error in the chart: bottom of hatched columns (diagonal stripes) applies to newsprint imported from Canada; top of hatched columns (vertical stripes) applies to newsprint imported from Europe.

Page 77

Column 2, paragraph 4, line 5: For 57 percent read 53 percent.

Fiberboards

SINCE the publication of a previous report on fiberboards in UNASYLVA,[1] remarkable progress in fiberboard manufacture had been made, both in the scientific field and in the practical application of the results of basic research.

Anatomical research, using new ways of coloring the various lamella of the cell walls differentially with metachromatic dyes, has given a clearer understanding of the influence that the morphology of the fibers and their treatment during the fiberizing process have on the ultimate properties of the felted mats and the dried and pressed boards. It indicates that these properties are not governed only by the fiber length, which has long been regarded as the decisive factor, but chiefly by the pliability of the fibers, which depends largely upon the relation between cell-wall thickness and diameter of the lumen. This conception has furthered the utilization of hardwoods.

So also has the increased understanding of the role that different chemical constituents of the cell wall play as binding agents. Although it is not yet entirely clear how far this binding action stems from the repolymerization of lignin (depolymerized first by light cooking, which lowers its melting point) and how far from the polysaccarides (chiefly hemicelluloses, uronic acids, and some extractive substances), considerable progress has been made in the technical utilization of these self-binding actions.

The properties of the chemical adhesives—especially artificial resins on a base of urea-, phenol-, or melamin-formaldehyde condensates, and bituminous products derived from petroleum—have also been improved through new methods of condensation, and methods have been evolved for dispersing these adhesives more finely through the woody fibers, chips, or granules that form the main part of the board.

This last-mentioned technique has brought about an important development in the so-called "dry pressing process," which overcomes some serious disadvantages of the old felt-forming process out of a very diluted slurry. The dry pressing process significantly reduces the necessary investment and the working costs, especially because of the savings which it effects in pressing time and in the caloric energy required for evaporating the water included, and because of the fact that wire nets do not have to be used. Moreover, the boards produced in this way have two smooth surfaces; their field of utilization has thus been widely extended and, as a consequence, their commerical value has considerably increased.

As significant progress in transportation and handling has also been achieved, economic production is now possible in small factories. The old wet processes required rather large production units for economic results.

Greater utilization of forest wastes has been made possible by the use of transportable machines which can be operated in the forests themselves. Some of these machines chip the branches, twigs, and tops and load them pneumatically into trucks; others divide the small, fresh lots roughly into fiber bundles by the action of rapidly rotating cylinders with very sharp, strong, and flexible needles. Similar methods for utilizing industrial wastes have been developed which lend themselves especially well to the fabrication of cores for blockboards, furniture, and other relatively thick parts.

A wide range of fiber and wood particle board products has been developed. At one extreme are the ultra-light boards with high thermal insulation properties, which are now produced by ingenious foam-building processes. These foam-building processes use finely dispersed air or the coagulation of dissolved lignin by means of carbon dioxide from flue gases blown through the liquid in fine dispersion. The other end is marked by super-hard boards which are, for instance, used as dies for the form-pressing of sheet metals.

Investigations on both these products were initiated by the FAO Committee on Mechanical Wood Technology at its third meeting in connection with the first Conference on Mechanical Wood Technology in Geneva in September 1949. The methods for testing fiberboards proposed here by the U.S. delegate—methods which had already been accepted almost in their entirety by some national wood research societies—were unanimously accepted as the basis of discussion and further development. In order to speed up the investigations, a special working group was appointed, consisting of the delegates from the countries in which the principal work on these tests is being done, namely, Canada, the United Kingdom, France, Sweden, and the United States. This unification will have a very important effect in developing the application of these products.

* * *

The present theoretical capacity of the world's fiberboard industry can be estimated at approximately 2,500,000 tons annually. However, for

[1] Vol. II, No. 4 (July-August 1948). It is considered necessary to repeat here the following footnote to the previous report:

"*Fiberboard*, as discussed in this report, refers to boards, sheets, or rolls, used mainly in building, of which the chief raw material is wood. Raw materials may be in the form of pulpwood, wood pulp, waste paper, sawmill waste, screenings, etc. Gypsum board and plaster boards are excluded.

"*Hardboard* (*Wallboard*) is a general term applied to fiberboard (hard and semihard) from 3 to 7 mm. (⅛ to ¼ inch) in thickness, used primarily in partitions, side walls and other construction work.

"*Insulating board* refers to insulating material in sheets or rolls usually from 8 to 20 mm. (⅛ to ¾ inch) in thickness with porous structure and good thermal and acoustic insulating properties. The fibers are sized and felted together to contain a large quantity of trapped or 'dead' air.

"The statistics of some countries do not distinguish between fiberboards in which the chief raw material is wood and fiberboards where the chief raw material may be bagasse, straw, gypsum, etc., and thus not all figures are directly comparable."

different reasons in different countries, operations are not at full capacity levels. But even under these circumstances, there have been indications of a partial saturation of the markets. This situation is attributable to a temporary slowing-down of demand for insulating boards in many parts of the world and to relative tardiness in the opening-up of new outlets. The demand for hardboards, on the other hand, has shown a strengthening trend. This has given impetus not only to a considerable increase in production of these types, but also to a preponderance of hardboard production in the planning of new factory capacity. The present ratio of hardboard capacity to softboard capacity is approximately 9 to 10. With the expansion plans that have so far been reported it seems likely that the world's hardboard and softboard capacities will about equal each other within two or three years. By that time, total world capacity could, when wholly used, produce close to 3,200,000 tons of fiberboards.

During the past three years the per caput consumption of fiberboards appears to have declined in certain countries which have previously absorbed proportionally high amounts of this material for construction and other purposes. On the other hand, vast regions with relatively dense populations are still using only marginal quantities of fiberboards. These facts suggest that the future of the fiberboard industry, in general, is largely dependent upon the extent to which the undersupplied or completely unsupplied markets can be opened up to this product.

Consumption

The rate of fiberboard consumption varies widely from country to country. In some parts of the world, the product has a well-established place in construction, and a relatively high rate of per caput consumption is maintained. But there are still vast areas, particularly in the tropical and subtropical zones, where the use of fiberboards is looked upon with prejudice. Experience shows, however, that once fiberboards (sometimes treated in special ways) are successfully introduced on new markets, the demand for them might rapidly rise. On the other hand, new uses of fiberboards are continuously gaining ground, as, for instance, the substitution of hardboard for plywood, which has affected both fiberboard production and trade during recent years.

On the basis of the information available, the following data for selected countries can be given as illustrating the present per caput consumption of fiberboards:

Country	*Per caput consumption* (*... Kilograms ...*)
Sweden	19.0
Norway	12.0
United States	5.0
Finland	4.0
Australia (1948)	3.0
United Kingdom	1.5
Union of South Africa (1948)	1.0
Argentina (1948)	0.6
Japan (1948)	0.2
India (1948-49)	0.03

The per caput rate of consumption varies from year to year, not only in those countries which, lacking domestic production, are completely or mainly dependent on imports and thus affected by factors influencing general trade, but also in the countries that are large producers with more or less stable home markets. For instance, Swedish domestic consumption, estimated in 1946 at 24 kilograms per caput, shows by 1949 a marked decline; similarly, U.S. consumption, which in 1946 averaged 8 kilograms per caput, was considerably lower in 1949.

Europe

Capacity and Production

The total annual capacity of European mills now in operation can be estimated at around 850,000 tons. Close to 60 percent of this total capacity is located in the three northern countries, Finland, Sweden, and Norway, the rest being divided among a great number of countries in all parts of the continent.

During the whole postwar period, fiberboard output in many of the important producing countries has been reduced as a result of temporary stagnations caused by modernization and enlargement works, shortage of electricity or fuel, or other conditions affecting production. Therefore, the gap between theoretical capacity and actual output has in numerous cases been considerable. Total European output of fiberboards, which increased very substantially from 1948 to 1949, still lags behind mill capacity.

The foremost producer of fiberboards in Europe, *Sweden*, has at present fifteen mills in operation with an aggregate annual capacity of more than 300,000 tons. Notwithstanding a certain caution in producing insulating boards because of marketing difficulties in this type, total output of fiberboards increased from 196,000 tons in 1948 to 233,000 tons in 1949, or by 19 percent. Production of hardboards, representing at present close to 80 percent of total output, reached a new peak figure in 1949 (185,000 tons against 172,000 tons in 1948).

By the end of 1949 *Finland's* fiberboard industry, with six mills in operation, had already reached the theoretical capacity of about 120,000 tons a year. Since during the year new machinery was about to be installed or was being run at low speed in a number of factories, total production did not exceed 54,900 tons, as compared with 42,400 tons a year earlier. Hardboard output in 1949 nearly doubled the previous year's volume (16,500 tons against 8,600 in 1948).

In *Norway* only three fiberboard plants were in operation during 1949. While their total capacity, after alterations and modernizations carried out during the year, amounts to about 70,000 tons annually, actual output in 1949 was 47,500 tons (39,000 tons in 1948), out of which 20,900 tons were classed as hardboards (17,400 tons in 1948).

Towards the end of the war, the seventeen fiberboard factories of *Germany* had reached an annual production level of about 75,000 tons of hardboards and over 14,000 tons of insulating boards. The redrawing of frontiers and dismantling which followed the war left only nine plants on German territory, representing a theoretical capacity of 53,000 tons of hardboards and 6,000 tons of softboards. Out of this total, factories capable of producing 12,000 tons of hardboards were situated in the Soviet Zone and the rest

in the Western Zones. By 1949, the number of plants in the Western Zones totaled nine, and the aggregate manufacturing capacity of these plants is estimated at 75,000 to 80,000 tons per year, out of which approximately 55,000 tons are hardboards. Actual production in the Bizone alone increased from 36,800 tons in 1948 to 56,800 tons in 1949, which was well above the peak figure arrived at during the war. The main part of the Bizone production is hardboards. Output in the French Zone has also increased considerably.

One of the dismantled German plants is now installed in the *Saar*. This factory produces about 3 million m^2 of "extra hard" board per year.

Austria has four fiberboard mills, with an aggregate production capacity estimated at around 30,000 tons a year. However, actual production lags far behind this theoretical figure. In 1949, it totaled 17,600 tons (in 1948, 13,200 tons), out of which 8,600 tons were hardboards.

The *United Kingdom* and *France* have at present three plants each, and the total annual capacity in each of these countries is 40,000 tons. Output of fiberboards in the United Kingdom increased from 34,200 tons in 1948 to 39,000 tons in 1949. The proportion of insulating boards has been about 60 percent of the total. Output in France in 1948 was 18,300 tons, out of which 10,300 tons were hardboards. The output figure for the first three-quarters of 1949 (13,900 tons) indicates that the whole year's production might have reached at least the previous year's level.

In *Italy* there are four factories of importance, which have a total annual capacity of some 29,000 tons. With a number of small plants, the country's aggregate capacity adds up to about 32,000 tons per year, 29,000 tons of which are hardboards. Total output in 1949 was 26,900 tons as compared with 25,300 tons in 1948. The main part of this production—nearly 92 percent in 1941 and 98 percent in 1948—was hardboard.

Belgium and *Switzerland* also belong among the medium-class European producers. Belgium, with two factories in operation, is reported to possess an annual production capacity of 25,000 tons, and Switzerland, with three factories, a total capacity of 20,000 tons per year. Belgian output has dropped slightly, from 15,800 tons in 1948 to 15,100 in 1949. Swiss production was estimated at 12,000 tons in 1949, as compared with 8,500 tons in 1948.

Toward the turn of 1948/49 the *Netherlands*, which had already produced some quantities of insulating boards, began operations at a new factory in Hoogezand. The plant, using straw as raw material, is equipped with machinery of the Defibrator type and has a capacity of 10,000 tons of hard and semihard boards and about 8,000 tons of insulating board. The country's total output increased from 2,600 tons of insulating board in 1948 to 5,100 tons of hardboard and 1,800 tons of insulating board in 1949.

Other Western European producers of fiberboard are *Denmark* and *Ireland*, the latter being a relatively recent newcomer. Denmark has a production capacity of about 8,000 tons per year. Its actual output in 1949 declined from the 1948 figure of 7,500 tons to 6,300 tons of insulating board. The only fiberboard factory in Ireland was put into operation in 1949. It is reported to have an annual capacity of 8,000 to 10,000 tons of hardboards made from straw.

Among the eastern European countries (excluding the Soviet Zone of Germany) *Yugoslavia* and *Czechoslovakia* are known to have one fiberboard factory each in operation. It is reported that the Yugoslavian plant has at present an annual capacity of 4,000 tons of hardboards, but that, after completion of enlargements under way, its capacity will be increased by 7,000 tons of hardboard. The Czechoslovakian plant is reported to have doubled its original capacity and to be able now to produce 12,000 tons of hardboards.

Outlook

It is reported that domestic markets for fiberboards in *Sweden* are expected to be further consolidated in 1950. Although exports of insulating boards may remain relatively low, continued strong demand for hardboards is expected to give impetus to increased production. The country's production capacity will be increased in accordance with this trend. Information available suggests that one new plant for hardboard manufacture, with an annual capacity of 23,000 tons, is under construction and that two additional hardboard mills are planned for the very near future, one of which, with an annual capacity of 10,000 to 12,000 tons, is scheduled to be in operation by the second half of 1951 and the other, with an output of about 12,000 tons a year, by the spring of 1952. By that time, the total capacity of the Swedish fiberboard industry is expected to reach nearly 350,000 tons, divided between hardboards and insulating boards in the proportion of 2 to 1.

As an exporter *Finland* is in somewhat the same position as Sweden, but it is believed that the possibilities for increasing domestic consumption of fiberboards are perhaps greater here than in Sweden, where the absorption on the home market is already relatively high. The capacity of existing Finnish mills has recently been increased by new machinery. One new plant, using sawmill waste as raw material and waste from a plywood factory as fuel, started operations at the beginning of 1950. This mill produces hardboards exclusively, and has a capacity of 10,000 to 12,000 tons a year. It is estimated that the country's capacity will, during the current year, reach the theoretical figure of 135,000 tons, out of which about 85,000 tons will be insulating boards.

A new plant, with a capacity of about 6,000 to 10,000 tons of insulating board, is scheduled to start operation in *Norway* during the latter half of 1950. The mill can be easily enlarged for production of other types of fiberboards. Another mill, producing about 10,000 tons of hard and semihard boards, will also come into operation during 1950. By the end of the year, the country will thus have five mills with an aggregate capacity of about 90,000 tons annually.

In Western Europe, where all the fiberboard-producing countries are also importing fiberboards, only *France* and *Spain* are known to have new mills under construction. The new French mill, scheduled to be completed in 1951, will have an annual capacity of 8,000 tons of hardboards. The first Spanish fiberboard factory, with a capacity of about 10,000 tons of hardboards, is planned to begin operations during the first half of 1951. Two of the fiberboard plants in the *United Kingdom* are reported to have planned

the installation of new machinery for the annual production of 10,000 tons of hardboard each. In addition, two of *Italy's* large hardboard plants are reported to be planning to double their production within the next two years.

In Central Europe, increases in capacity in *Western Germany* and *Austria* are planned for the near future. In Western Germany one new plant, with an annual capacity of 9,000 tons of hardboard and 4,000 tons of insulating board, is under construction, and will be completed in 1951 or 1952. In Austria, three new plants for the manufacture of hardboards are projected.

According to plans reported, considerable new producing capacity will come into being in the Eastern European countries during the next few years. *Yugoslavia* is scheduled to complete by 1951 the construction of a mill with an estimated capacity of 12,000 tons of hardboards and 6,000 tons of insulating boards. In *Czechoslovakia*, a new plant with an annual capacity of 10,000 tons of hardboards and 8,000 tons of insulating boards was to be put in operation toward the middle of 1950, and another factory with similar capacity at the beginning of 1951. Moreover, the economic plan of *Poland* provides for the construction of three plants, each with a capacity of 10,000 tons of hardboards and 8,000 tons of insulating boards between 1951 and 1953. The current five-year plan of *Hungary* also provides for the erection of one fiberboard mill with an annual capacity of 10,000 tons. The actual production and the plans for the future in *Romania* are not known.

On the basis of these data, approximate though they are, it can be estimated that European capacity will be increased within the next two years or so by an additional 250,000 to 300,000 tons. The installation of new machinery and the construction of new plants are designed primarily to increase output of hardboards.

North America

Capacity and Production

The *United States*, by far the world's greatest fiberboard producer, has at present more than twenty fiberboard mills in operation. Their aggregate annual capacity can be estimated at about 1,200,000 tons (including laminated board), roughly one-third of this quantity being hardboard and two-thirds insulating board.

Actual production of fiberboards in the United States increased rapidly during the earlier postwar years, the volume rising from 868,000 tons in 1946 to 973,000 tons in 1947 and 1,152,000 tons in 1948. In 1949, however, output declined sharply to about 801,000 tons. This drop was attributed to strikes, one of which paralyzed the mill of one of the larger producers for several months and another of which, in an allied service industry, kept a second producer idle for a similar duration. Toward the end of the year, however, the production rate improved, and during the first quarter of 1950, output was almost 250,000 tons. If the first-quarter rate continues evenly throughout the rest of the current year, the volume of production for 1950 could reach at least the 1947 figure.

Canada is reported to have five large fiberboard plants in operation. The newest of these, situated in New Westminster, British Columbia, is manufacturing pressed hardboards from the wood waste of a plywood plant. Present Canadian capacity is estimated at close to 200,000 tons per year. Production, which amounted to 118,000 tons in 1946, increased to 145,000 tons in 1947 and to 149,000 tons in 1948. In 1949, it reached the peak figure of 171,000 tons.

Outlook

It is reported that a big company in the United States is enlarging its plant by new machinery with an estimated annual capacity of 100,000 tons of insulating board. Another company is scheduled to complete during 1950 a new factory which will manufacture 80,000 tons of hardboards. Taking into account some further additions and eventual new plants in Canada also, it has been estimated that North American capacity may increase within the next two years by at least 200,000 tons.

Other Areas

U.S.S.R.

The Soviet Union, which produced some fiberboard in the prewar years, is reported to have at least one fiberboard plant at present with an estimated annual capacity of 10,000 tons of hardboard and 8,000 tons of insulating board. It is not known, however, whether this plant is in operation. There are important plans for increasing fiberboard production capacity during the years to come. According to reports, seven new factories are to be constructed during 1951-54, with an aggregate annual capacity of 70,000 tons of hardboard and 56,000 tons of insulating board.

Africa

A Masonite type of factory was to start production in the *Union of South Africa* toward the end of 1948 or the beginning of 1949. Its capacity is estimated at 20,000 tons annually, and the major part of production, it is reported, will be hardboards.

During the war, two small plants in *British East Africa* were in operation sporadically, but since then nothing has been heard about their activity.

Plans for establishing fiberboard mills in the *French Tropical Territories* have been postponed, possibly with the exception of one plant with a 10,000-ton capacity in Gabon. It is estimated that by 1952 the French Overseas Territories will produce 20,000 tons of fiberboards.

Asia

In Asia, only *Japan* is at present producing fiberboard. Its production amounted to 9,000 tons in 1947 and reached a volume of 18,000 tons in 1948.

India has been experimenting, however, with the manufacture of building boards using bamboo as the principal raw material, and the results at the laboratory level have been promising. If these experiments prove economically favorable, development of an industrial capacity on this basis could have importance for the whole bamboo-growing region of South and East Asia.

Proposals for the rehabilitation of *Indonesia* envisage the establishment of a fiberboard industry in 1952/53. Realization of any such plans is, however, reported to depend largely on the possibility of mobilizing foreign capital.

Oceania

Australia at present has two fiberboard factories; one of these uses cane as its raw material, and the other is based on the Masonite process. Production of softboard manufactured from sugar cane depends on the output of the sugar industry, and has remained relatively constant at about 9,000 tons annually. This volume of production does not meet the demand, but it is considered that increased supply ought to be obtained by expanding the output of softboard manufactured from other materials. Australian hardboard production is using as raw material relatively low-grade material from mixed hardwood forests. Output was about 10,600 tons in 1947, and it was hoped to reach a level of 17,000 to 18,000 tons by 1950. One new plant with an annual capacity of 10,000 tons of hardboard is reported to be under construction in Tasmania; it is scheduled to start operation in 1950 or 1951.

The only fiberboard factory in *New Zealand* has an annual capacity of 20,000 tons. During the year 1948/49, total output was 13,000 tons.

Latin America

In *Brazil*, one plant has sporadically produced insulating board from banana tree stems, but it reportedly stopped operations in mid-1949 because of lack of raw material. A new and larger mill is reported to be under construction in the State of São Paulo for the manufacture of softboard.

Argentina has now completed the construction of its first fiberboard plant. The factory is equipped with Swedish machinery and has an annual capacity of 10,000 tons of hardboards manufactured from wheat and flax straw. Its production, it is reported, will exceed domestic requirements.

The only fiberboard factory in *Peru* is estimated to have an annual capacity of no more than 1,000 tons. Plans for constructing a plant in *Chile* are reported to have been suspended.

The latest newcomer among fiberboard producers in Latin America is *Mexico*. Its first plant, equipped with machinery of the Defibrator type, is scheduled to be completed in late 1950. It will have an annual capacity of about 10,000 tons of hardboard.

International Trade

Export trade in fiberboards has traditionally been dominated by North America and the Northern European countries. Since 1947, the Canadian and United States export figures have been constantly declining, whereas Sweden, the world's biggest fiberboard exporter, and Finland have been able to increase their exports. Austria has also shown activity on the export markets lately.

For the United States, the largest producer of fiberboards, exports are of very minor importance, representing in 1949 less than 3 percent of production. In contrast, Canada exported nearly 19 percent of its production in 1949; Norway almost 20 percent, Austria more than 32 percent, Sweden about 42 percent, and Finland almost 58 percent.

During the last three years, shipments from the principal exporting countries have been as follows:

Country	1947	1948	1949
	(... Thousand tons ...)		
Austria	3	3	6
Finland	..	29	32
Norway	5	10	9
Sweden	76	95	98
Canada	47	41	32
United States	37	33	21

Some other countries—for example, Belgium—export considerable quantities of fiberboards from time to time, and it is worth mentioning that New Zealand has lately joined the group of exporters. Moreover, there are indications that Italy may show some activity on hardboard markets abroad.

During the past few years, two important trends have manifested themselves in the fiberboard trade. One of these is a somewhat weakening demand for softboards and a relatively strong demand for hardboards; the other is the closing of markets for imported fiberboards in a number of countries and the opening of new markets in other countries. Both of these trends indicate that a definite movement is going on and that it would be premature at the present moment to speak of any stabilized pattern in the fiberboard trade.

The United Kingdom has been the largest importer of fiberboards, followed by the United States, the Netherlands, and Belgium. Imports of the principal receiving countries during the last three years have been as follows:

Country	1947	1948	1949
	(... Thousand tons ...)		
Belgium	10	8	11
Denmark	9	7	16
France	5	3	..
Netherlands	13	29	25
Switzerland	4	3	1
United Kingdom	34	49	37
Canada	19	14	..
United States	30	27	20
Brazil	[1]3	.2	..
India	[1]6	[2]9	..

[1]Years 1947-48.
[2]Years 1948-49.

In certain countries—notably France and Switzerland, and also the Union of South Africa and New Zealand—fiberboard imports have declined as a result of rising domestic production. However, new markets have opened in other parts of the world. For instance, it is reported that in 1949 Sweden and Finland shipped about 12,000 tons of fiberboard to Australia and more than 10,000 tons to Argentina. Some increase in fiberboard imports is also shown for Israel, British East Africa, Malaya, Hong Kong, and Brazil.

During the first months of 1950, imports to the United Kingdom indicated a definitely strengthened demand, obviously as a result of the relaxation of controls.

The Work of FAO

Report of the FAO Forestry Mission to Austria

WHILE in Vienna in July 1949 the Director-General of FAO was approached by the Austrian Government with a request for an FAO forestry mission to advise on programs for the development and improvement of Austria's forest resources and industries. The Director-General appointed two permanent staff members of the Division of Forestry and Forest Products: Dr. Egon Glesinger, Deputy Director of the Division, and Mr. D. Roy Cameron, Chief of the European Working Group, to form that Mission. They arrived in Vienna in January 1950 and in April a report was presented to the Austrian Cabinet by Mr. A. H. Boerma, Regional Representative of the Director General in Europe.

The report of the FAO Forestry Mission to Austria is an important document because: (1) it is the first time that an international organization has made a comprehensive investigation of the forestry situation in a country, including the status and potentialities of the industries dependent on the forest resources for their raw material supplies; and (2) the report makes far-reaching recommendations, the implications of which affect the whole national economy.

On the basis of proposals formulated by Austrian forest owners and manufacturers, the Mission has recommended for the next three years an investment of 1,700 million schillings (corresponding roughly to 80 million dollars) for the improvement and modernization of the country's forest resources and industries. Such an investment would raise the annual output of primary and secondary products derived from Austrian forests, which now represent approximately 9 percent of the annual national product, to 2,800 million schillings, i.e., by more than 30 percent. It would enable Austria to increase annual exports of forest products by 600 million schillings, or almost 60 percent, between 1949 and 1952, assuming no radical change in present price levels. The importance of such a development is best illustrated by the fact that in 1949 forest products exports attained a value of 1,100 million schillings, corresponding to 32.6 percent of Austria's total exports. The anticipated expansion of forest products exports would thus go a long way in closing the present gap in Austria's balance of payments.

It was peculiarly fitting that Austria should be the first location of an international forestry mission, because of the long tradition of leadership in the science and art of silviculture accorded that country by the world. Furthermore, forests are Austria's most important natural resource and the rehabilitation of the national economy must depend in large measure on the efficient development and expansion of its forest industries.

Fortunately the special ECA Mission to Austria recognized this fact promptly and expressed its willingness to further in any way possible large-scale and long-term plans for the modernization of forest industries.

The Austrian Government was also aware of the opportunity afforded for additional capital investments which the European Recovery Program assistance made possible. A very comprehensive long-term forestry program was prepared by the Austrian authorities, and the various industrial associations compiled briefs indicating their plans for expansion and the financial commitments which these would necessarily involve.

The work of the Mission therefore consisted primarily in the analysis of these plans, their correlation with the assessed productive capacity of the Austrian forests, and their integration into an over-all investment program for forestry and forest industries.

The report of the Mission is in two main parts. *Part 1* contains a summary of its conclusions and four important recommendations. *Part 2* is a detailed discussion of the individual items in the program. It deals first with the forestry aspects and then formulates the Mission's proposals with respect to each section of the forest industries.

In its general recommendations in Part 1, the Mission had to take into account the fact that the financial assistance which could be made available under the ERP program must end with the termination of the Marshall Plan in 1952. On the other hand, the investment requirements, particularly for forestry, must continue over a term of years. Furthermore, the productive capacity of Austrian forest industries requires a raw material supply considerably in excess of the yield capacity organized as at present.

The Mission's first two recommendations concern the financial basis of the investment program. The first recommendation proposes the creation of a government-controlled Forestry and Forest Industries Finance Corporation. This Corporation would operate through four technical committees for forestry, sawmills, other wood-working industries, and pulp and paper. These committees would have the responsibility of initiating action on investment projects and approving loan applications which would be made directly to them. The chairmen of the committees would sit on the Board of Directors, which would also include members of the Cabinet, heads of Ministries interested in the program, and representatives of the leading national political parties. The General Manager of the Corporation would be responsible for the actual completion of loans approved by the committees.

The Mission's second recommendation is for the establishment of a revolving fund to meet the long-term investment requirements. Into this fund, which would be administered by the Corporation, would go all the interest and amortization charges of loans to be made under the program. It would also receive at the termination of Marshall Aid in 1952 all unused balances from allocations for investments expenditures made during the life of the ERP.

The third recommendation proposes an expansion of Austrian research facilities, both in forestry and forest products. For forestry it recommends the establishment of a new research center to which should be attached a demonstration forest. The present institute at Mariabrunn would be continued as a branch station. A forest products laboratory is also proposed, to work on problems of applied research designed to service the requirements of Austrian forest industries. In addition, a continuing subsidy is recommended for the Austrian Society of Wood Research, which will be engaged more particularly on problems of a more fundamental, scientific character.

The Mission's fourth recommendation is for the establishment of an Austrian Forestry Commission, to be responsible for the heavy investment program required to rehabilitate Austrian forests, which have suffered from two wars and a major depression. This Commission would have as its chairman the Minister of Agriculture, who is in charge of forestry affairs. It would report directly to the Cabinet and would have the status of a Ministry. The Mission suggests that the Commission should have as its chief executive officer a Director General, and be organized in six major divisions, namely management, utilization, economics and service, research and surveys, torrent control, and State forests. The proposal that the State forests should be integrated in an over-all administration involves a fundamental organizational change in Austria. This will take some time to effect because of complications connected with the constitution of the Federal Republic. The Mission points out, however, that State forests must in the future play that part which over-all forest policy demands, even though this may not be the most profitable from the standpoint of the State forests themselves. Particularly, reductions or in-

creases in the volume of fellings should take into account the essential needs of industry rather than be dictated primarily by price trends.

In addition to its four main recommendations, the Mission makes in Part 1 certain additional suggestions concerning the better use of thinnings to be made available in large quantities through forest improvements and the maximum utilization of wood waste by the pulp and paper and wallboard industries. It also points out the desirability of changes in the incidence of taxation to encourage industry to take advantage of the loan facilities available under the investment program.

From the standpoint of the long-term economic prosperity of Austria, the recommendations with regard to forestry are perhaps the most important. The Austrian forests have been seriously depleted and their productive capacity impaired. Since World War I, overcutting is estimated to have amounted to 70 million m^3. Still worse, there has been an accumulation of cutover lands which it has been impossible to replant and thus return to production. Over 300,000 hectares, or approximately 10 percent of the potential forest area, have now been reduced to this category.

As a result, the productive potential, which in 1936 was estimated at 9.5 million m^3, has fallen to what Austrian forest authorities place at around 7,700,000 m^3 at the present time. The Mission has proposed an allowable cut after 1952 of 9 million m^3. The justification for this higher figure is the fact that current statistics are admittedly incomplete in that they do not include important quantities of wood going into construction or fuelwood for domestic use on farms. Secondly, the forest improvement program will make available large additional volumes of thinnings from areas now economically inaccessible and where as a consequence proper silvicultural treatments have not been possible.

The two most important elements of the forestry program proposed by the Mission are reforestation and increasing forest accessibility. The planting program prepared will be deferred until after 1952, but the remaining period of Marshall Plan aid should see the installation of the additional forest nursery stock and the purchase of all necessary modern equipment. The Mission's proposals call for an expenditure of 38.5 million schillings per annum for reforestation for a 16-year period following 1952.

The forest improvements program is designed to open up an area of over 143,000 hectares of timber by the construction of roads and permanent cable ways. It is proposed that practically the entire construction program should be initiated within the life of the ERP. About 90 percent of the expenditure will be in the form of loans, the proceeds of which will constitute an important part of the Revolving Fund, most of which will eventually be used in the reforestation program.

Another important element in the forestry program is the preparation of a forest inventory. In the initial stages this will have to be conducted by ground survey methods. However, as soon as the Austrian Peace Treaty is signed and the use of aircraft can be sanctioned, aerial survey methods will be introduced.

The Mission has also endorsed the recommendations of the Austrian authorities for a number of minor projects designed to increase the proportion of industrial wood coming from the country's forests. These include the replacement of wooden shingles by tiles in house construction, improved wood-burning stoves, preservative treatment of wood for external use, and the development of peat production.

In the industrial field the Mission was particularly concerned with the modernization and expansion of the sawmilling and pulp and paper industries, and the possibilties of integration between them. Today these two basic primary forest industries exist as competitors and there is little if any systematic co-operation between them. In the sawmilling industry the equipment of most mills is deficient and manufacturing processes obsolete. Owing to the mountainous nature of the country there will always be necessity for a large number of small mills to service local needs. There is, however, room for modernization of a relatively small number of larger units producing for the export trade, which with better manufacturing and lower costs could be greatly expanded. The Mission report stresses that well-equipped, medium-sized mills, which can obtain their log supply relatively close at hand, will best serve Austria's economy. The report recommends capital investments for this purpose.

Modernization is also essential in the pulp industries and would permit a reduction of around 20 percent in production costs. Large increases in industrial capacity are not warranted in view of the limitations of raw material supply. The Mission's report therefore recommends two small expansions only, one to provide for the manufacture of some 60,000 tons of groundwood pulp and the other for the establishment of a new factory for the manufacture of sulphate pulp.

The Mission sees in the wallboard industry prospects of an increasingly important asset in the country's economy, more particularly as this industry may be organized to utilize a large quantity of sawmill waste now serving no useful purpose. The report recommends the building of two additional factories and modernization of existing equipment. Comparatively small capital investments are also recommended for the other primary industries, veneers and plywoods.

In the secondary industries particular attention is paid to paper and cardboard, where total capital investments totaling over 280 million schillings in the first priority are recommended. An equivalent amount is placed in the second priority. These capital investments are designed to raise the manufacturing capacity of the industry by 120,000 tons per annum or 42 percent over 1949. Total export supply by 1952 should exceed 200,000 tons and make an important contribution to the national economy.

The manufacture of containers and crates for export has reached sizable proportions in Austria. The Mission has recommended investments for capital equipment which in the opinion of the industry will enable it to accept large-scale orders and thus better meet competition in this field.

Austria has a high reputation as a producer of prefabricated houses. After enquiry into this industry, the Mission concluded that further expansion of capacity was not desirable. However, it endorsed proposals for relatively modest capital investments for the introduction of modern equipment for further increases in efficiency and for possible adjustment in output towards the manufacture of sash and doors and other mill work. Similarly, with regard to furniture, for which Austria is well known, modest scale investments were endorsed for modernization of existing production capacity.

Regional Meeting on Standardization of Timber

A TECHNICAL meeting on nomenclature, terminology, testing methods, grading, and dimensions of timber was held at Dalat, Viet Nam, from 3-7 April 1950 and was attended by 18 delegates and observers representing the French Union (Viet Nam, Cambodia, and Laos) Hong Kong, Indonesia, Malaya, Thailand, SCAP (Japan), and the United States of America.

FAO was represented by Mr. W. H. Cummings, Regional Representative of the Director-General, and Mr. C. Purkayastha. Dr. M. A. Huberman, Chief of the Forestry and Forest Products Working Group for Asia and the Far East, acted as Secretary of the meeting.

Papers submitted for consideration at the meeting included grading rules for logs and lumber, and material on nomenclature, terminology, testing methods, and dimensions. These were submitted by Burma, the French Union, India, Indonesia, Malaya, New Zealand, the Philippines, and Thailand.

Consideration of this material, together with the proceedings of the first Conference on Mechanical Wood Technology held at Geneva in September 1949, and also the report of the Mysore Conference on Forestry and Timber Utilization held in April 1949, resulted in the adoption of the following recommendations:

Nomenclature

The Meeting—

1.—*Recommends* that the participating countries should group their timbers into five categories, as follows: (1) Teak (*Tectona grandis*); (2) Conifers; (3) Primary (durable) hardwoods; (4) Sec-

ondary (semi-durable) hardwoods; (5) General utility hardwoods. (Primary hardwoods are heavy constructional timbers that will normally last more than five years if used in an untreated condition in contact with the soil in termite-infested areas. Secondary hardwoods are also generally suitable for heavy construction but must be treated with preservatives if they are required to last more than five years in contact with termite-infested soil. General utility hardwoods are those relatively light timbers that are in general use for interior construction and purposes such as packing cases, sheltering, etc.).

2.—*Recommends* that countries agree to send to the FAO Regional Office at Bangkok a list of the trade names of their commercial timbers classified as far as possible as recommended in the first resolution. An appendix to this list should contain details of the density, durability, color, and ease of sawing of each commercial timber.

3.—*Recommends* that timbers of similar characteristics should be grouped under one trade name.

Terminology

The Meeting agrees to the definitions of defects and of the more important terms used in the timber trade that are set out in the Malayan Grading Rules, with the proviso that they may submit additional definitions and amendments to the FAO Regional Office at Bangkok for incorporation in this list if agreed upon at a future conference.

Testing Methods

The Meeting—

1.—*Agrees* with the Resolutions regarding methods of timber-testing passed at the first Conference on Mechanical Wood Technology at Geneva in September 1949 but *recommends:*

a) That the cross-sectional dimensions of test pieces shall be restricted to 2 x 2 cm. or 5 x 5 cm.

b) That the moisture content of test specimens in an air-dry condition shall be 15 percent, plus or minus 2 percent based on weight when oven dry, and that the results shall be published as obtained at the time of the test.

c) That tests shall be made as far as possible within the range of 25° C. plus or minus 3°.

d) That the tension perpendicular to grain test shall not normally be carried out.

2.—*Recognizes* the necessity of establishing standard methods of making moisture-strength and temperature-strength adjustments and, with this object in view, proposes to study the recommendations made at the Timber Mechanics Conference held in Ottawa in 1948.

3.—*Recognizes* the great importance of achieving as much uniformity as possible in the methods of selection of test material, and proposes an exchange of information through the FAO Regional Office in Bangkok so as to obtain if possible complete uniformity in selection methods within this region.

4.—*Agrees* that no suitable equipment exists in any of the regional laboratories for the testing of abrasion and *recommends* that close touch be kept with any new developments which may be made in respect of this test.

5.—*Recommends* that if any laboratory is to undertake tests on plywood or similar material, a study should be made of the standard methods set out by the American Society for Testing Materials in their A.S.T.M. D.805-47. Furthermore, it is recommended that close attention should be paid to the work being carried out at Dehra Dun, India.

6.—*Recommends* that an exchange of information on methods of carrying out durability tests should be conducted through the FAO Regional Office at Bangkok to ensure standardization of such tests.

Grading

1.—*Teak.* The Meeting *recommends* that the Burma Grading Rules should be adopted for the export of teak squares, but recognizing that there are differences in the quality of teak from different countries, considers that no agreement can be reached at present regarding that of very high quality and sawn teak for special purposes. Delegates agreed to forward their specifications for teak for high quality and special purposes to the FAO Regional Office at Bangkok so that studies can be made with the object of attaining a greater degree of standardization.

2.—*Conifers.* The Meeting considers that as there is very little export trade in conifers, there is at present no need for standard grading rules for this type of wood, particularly as there is such a great divergence in the type of coniferous wood growing in these regions. But it *recommends* that a study be made of the problems involved in the grading of such timbers.

3.—*Hardwood Logs.* The Meeting *recommends* that the North Borneo Standard Grading Rules shall be accepted as a basis for the grading of hardwood logs for export. It proposes that four grades shall be drawn up for presentation at a future conference.

4.—*Hardwood Lumber.* The Meeting *recommends* that if any country of this region is to start exporting sawn hardwoods, it should grade according to the Malayan Grading Rules and that those countries which already have an export trade in sawn hardwoods should study these rules and conform to them as closely as possible. However, it invites countries to make a comparative study of the method used in the Malayan Grading Rules with that developed in France. It is noted that the Philippine Islands wish to retain their rules for grading Philippine mahogany for export and that North Borneo does not wish to change its existing rules at present.

Training of Grading Inspectors

The Meeting, recognizing the importance of the proper training of timber grading inspectors, *recommends* that arrangements for the training of such inspectors in Malaya or other countries shall be made either directly or through the facilities of the FAO Office at Bangkok.

Dimensions

The Meeting—

1.—*Agrees* that the metric system of measurement of timber has advantages over all other systems but cannot recommend the general adoption of this system at present. However, it suggests that in the region only cubic meters and cubic feet be used to record the volume of timber, and requests the FAO Bangkok Office to draw up a table for converting dimensions in feet and inches to meters and centimeters.

2.—*Recommends* that all countries send to the FAO Office at Bangkok lists of the standard dimensions of timbers for export and requests that office to draw up a table including all these dimensions so that some common standards may eventually be evolved.

3.—*Recommends* that all timber for export should generally be cut oversize to allow for shrinkage.

These recommendations will be submitted to the first session of the Forestry and Forest Products Commission for Asia and the Pacific, to be held in October, and will form a basis for the Commission's policy decisions.

Ninth Session of the FAO Council

THE Council of FAO, meeting in Rome 8-17 May, made financial and administrative arrangements for transferring the Organization from its temporary home in Washington to its permanent seat in Rome early next year. It also set 3 November 1950 as the time and Washington as the place for a session of the full Conference to approve the final arrangements for the move. The Council is an interim governing body composed of 18 of the 63 member governments, and is under the independent chairmanship of Lord Bruce of Melbourne.

In connection with the program of technical assistance, the Council laid great emphasis upon the need for integrated action among the various participating agencies, including not only FAO, but also the World Health Organization, the International Labour Organisation, the United Nations Educational, Scientific and Cultural Organization, and the United Nations itself. It urged discrimination among the numerous possible projects and the closest liaison with governments.

The Council also put under way a study of the work of various international organizations as this relates to FAO's program, looking toward avoidance of duplication and more effective co-operation.

European Forestry and Forest Products Commission — Subcommission on Mediterranean Problems

THE Mediterranean Subcommission held its second meeting at Algiers 8-13 May 1950, with the following countries represented: France, Algeria, Tunisia, Morocco, Israel, Italy, Portugal, Switzerland, and the United Kingdom. The International Union of Forest Research Organizations was also represented.

Professor Aldo Pavari, Director of the Forest Research Station at Florence, and Jean Paul Challot, Conservator of Forests in Morocco, were unanimously reelected to the posts of Chairman and Vice-Chairman.

The Subcommission examined the report presented by Messrs. Pavari and Birraghi of the Italian delegation on the problems raised by chestnut blight (*Endothia parasitica*) in the Mediterranean area. It was deemed advisable to await the results of the International Chestnut Congress, to be held in France in September, before drawing any specific conclusions. Liaison with the Congress will be maintained by the Secretariat.

As decided at the Subcommission's first meeting in Rome in December 1948, a provisional map had been compiled indicating (a) the boundaries of the European-Mediterranean area and (b) the boundaries of the transition countries. The criteria adopted have been set forth in previous reports and discussions. The provisional map will be sent to each of the countries concerned, and corrections and comments made thereto will then be used in drawing up a definitive map. The Subcommission requested the interested countries to send the Secretariat all pertinent documentation which might serve in the compilation of this map, which will then become the official map of the Subcommission.

The Subcommission also requested the countries to submit to the Secretariat all documentation which would help in making the detailed ecological map called for by the Rome meeting.

In connection with cork research and production, three points were raised:

(1) *Permanent markets.* Will there still be a world market for products from these stands of cork-producing trees 30 or 40 years hence? The answer to this question seems to be in the affirmative.

(2) *Production statistics.* The study of statistics was the first point stressed in the report on the promotion and protection of the Mediterranean cork-growing industry which was presented by the Portuguese delegation. The report was adopted by the Subcommission as constituting an acceptable summarization of its work in this connection.

(3) *Methods of increasing and regularizing production.* The above report also summarized all questions which might arise in connection with cork production. All are of great interest, and it is necessary to establish an order of priority for treating these research problems.

The Subcommission was of the opinion that technical matters should be given immediate priority; it therefore decided to establish a permanent Working Party, presided over by Mr. J. V. Natividade (Portugal).

Finally the Subcommission considered reforestation, soil conservation, and land use, and, after hearing several reports, reaffirmed the conclusions reached at the Rome meeting. However, since a program of reforestation for rehabilitating steep slopes involves the control of grazing and the shifting and re-establishment of populations, and since it can only begin to influence water run-off after a considerable time, the Subcommission believes that steps must also be taken to ensure that: (1) the ground is so treated that the effects shall be the same as a forest cover as far as soil conservation and water regulation are concerned; (2) an intensive utilization of the soil is made possible so as to help raise the living standards of the populations in mountainous areas.

Following an inspection of the vast embankment works completed in Algiers by the Soil Protection and Restoration Service, the Subcommission found that the technique evolved for establishing "infiltration embankments" seemed to provide one of the best solutions thus far offered for carrying out reforestation work in the Mediterranean region. The Subcommission called the attention of all other governments to this technique, which has already been successfully applied here on a very large scale (almost 20 thousand hectares so far) and is worth copying. It recommended wider dissemination among governmental and technical circles of the interesting reports submitted, in order that all Mediterranean countries might benefit quickly from the experience already gained. It again pointed out to governments the danger implicit in any policy of land utilization involving the further clearance of forests on the pretext that, with modern soil restoration techniques, additional land can now be safely placed under cultivation. It recommended:

(1) That a firm policy of conservation and improvement of existing forests be followed;

(2) That soil restoration work be confined to areas where the forest vegetation has already disappeared and to agricultural land already denuded by or threatened by erosion;

(3) That reforestation combined with soil restoration methods be applied in areas where soil conditions so require.

No definite location or time for the next meeting was fixed, but the Subcommission agreed to place on its agenda a study of the need to restrict grazing in order to establish a proper equilibrium between grazing and forest lands, with a view to restoring the forests and ultimately obtaining the maximum yield from the land.

From 15-19 May, excursions were made to various places of interest in Morocco, where the delegates were greeted by M. Grimaldi, Director of the Forest Service, M. Challot, Director of the Soil Conservation Service, and M. Metro, Chief of the Research Station at Rabat. Much useful information was obtained on the work being carried out on silvicultural treatment of cedars, planting of eucalypts and acacias, management of cork-oak forests, and ecological problems.

The full report of the Subcommission is issued by FAO from Geneva.

Preparations for Technical Assistance Program

AS POINT FOUR of his message of 24 June 1949, the President of the United States recommended to Congress the enactment of legislation authorizing an expanded program of technical assistance to underdeveloped areas. The United Nations and the specialized agencies, which already have devoted much time and effort to assisting countries in their social and economic development, is also assuming part of the task of making such technical assistance available.

Pending legislative authorization and the necessary appropriations, a great deal of constructive planning has been done within the United Nations and the specialized agencies preparatory to the selection of projects for the program. The UN Economic and Social Council has provided for the establishment of a Technical Assistance Board (TAB), composed of executive heads of UN and the specialized agencies, with such functions as will assure co-ordination of the various activities under the program. The work of the Board is subject to review by the Council, which has established for this purpose the Technical Assistance Committee (TAC), a special committee of delegates from member countries.

Within this framework, the various specialized agencies will receive allocations in prescribed proportions when funds have been made available through contributions by participating governments. Of these contributions, which will be paid into a special account set up by the UN Secretary-General, FAO will receive the highest percentage (29 percent).

This is an indication of the important task which awaits FAO, particularly in the early years of economic development.

A special Technical Assistance Conference was held at Lake Success, beginning 12 June, to ascertain what contributions governments were prepared to make, to decide on all administrative arrangements, and to review the proposed programs of technical and economic development.

It is now assumed that some contributing governments will make their first payments for the initial financial period (July 1950-December 1951) in July of the current year, so that funds will be available by that date to cover specified projects based on formal requests by governments.

In FAO a working group on the level of divisional directors, presided over by the Director General or the Deputy Director General, has been established since 1949 to determine general policy regarding technical assistance and to coordinate the work within FAO and with UN and the other specialized agencies. Details of planning are carried out by an interdivisional working party in which each division is represented by an officer specifically in charge of technical assistance.

This working party examines the preparatory work done by the divisions; considers administrative problems to be anticipated; devises methods of co-ordinating FAO work with that of other agencies; suggests procedures for consultation with governments; prepares agreements with recipient governments; prepares proposals for establishing adequate registration and filing systems for Technical Assistance projects; keeps FAO's progress in this field continuously under review.

The Division of Forestry and Forest Products has given special attention to technical assistance programs. Its regional offices have aided interested governments in drawing up well-considered programs covering all projects for which technical assistance would be requested. These programs, after review and coordination at Headquarters, are now serving as basic documentation for the formal requests which are required from governments for any financial allocation from the Secretary-General's Special Account. The recipient governments must also give reasonable assurance that they will adhere to the guiding principles recommended by the Economic and Social Council and approved by the General Assembly to facilitate the implementation of technical assistance furnished. This means that they commit themselves to help the experts to obtain the necessary information about the problems on which technical assistance has been requested; to give full and prompt consideration to the technical advice received; to maintain or set up as soon as practicable such governmental co ordination machinery as may be needed to utilize its own technical, natural, and financial resources, so as to improve the standard of living of its people and ensure the effective use of any major international technical assistance; to undertake the sustained efforts required for economic development, including continuing support and progressive assumption of financial responsibility for the administration of projects initiated at its request under international auspices.

The successful operation of such a broad program will increase the prestige and effectiveness of the recipient countries in proportion to the results obtained. The Technical Assistance Program will strengthen the UN and its specialized agencies in the accomplishment of one of its fundamental purposes: constructive international action for improving the standard of living of the world's peoples.

Forestry Equipment

THE introduction of mechanized equipment has been one of the most revolutionizing factors in modern agriculture. For some time now this development has become evident also in forestry; yet forest utilization and especially logging operations are still carried on in most places by manual labor or the use of draft animals. Even when large-scale operations are undertaken very few of the operations are carried out with mechanized equipment, and then it is usually only the transportation phase that is modernized. As a result of this situation not only is the cost of harvesting the product very high, but also the working and living conditions of forest workers have been, in most cases, way below standard.

In order to let member countries reap the full benefit of the possibilities opened up by mechanization, the 1948 session of FAO's Conference recommended that all possible assistance should be given to governments to ensure that they could avail themselves of progress in this field. The response to this recommendation has been immediate. The advantages are evident not only for countries where forestry is well developed—since additional mechanization may bring forests formerly considered "inaccessible" within the orbit of commerce (inaccessibility, in most cases, is a matter of cost, i.e., transporting the wood from the forests)—but also for underdeveloped countries where large-scale forest utilization would not otherwise be possible because of working conditions, manpower shortages, and economic factors.

In accordance with the Conference recommendation, the Division of Forestry and Forest Products has endeavored to make available all pertinent data on forestry equipment. The Equipment Section has collected technical information, catalogues, and specifications from some 2,500 firms, from all over the world, whereas existing literature is usually confined to one country only. The data covers mechanized equipment used in logging and woods operations as well as in fire-fighting, nurseries, and all wood-converting industries. The first step was to collect data on tractors, both wheel and track types. This is now being extended to cover tractor-mounted equipment for forest utilization. The next steps will be equipment for loading and transportation.

A special study on fire-fighting is being carried out, dealing with equipment for fire prevention, communication, transportation, and fire-fighting in general. This will enable interested countries to keep informed of the latest developments in equipment as it is used in different parts of the world.

These data are available to member countries upon request, and it is hoped that it will be possible to publish them in the form of a compendium. Information has already been supplied to the following countries: Austria, Bolivia, Brazil, Iran, Thailand, Venezuela, and Yugoslavia.

United Nations Mission to Bolivia

A UNITED NATIONS mission left in April 1950 for Bolivia, at the request of the Bolivian Government, to determine what technical assistance is necessary for improving the economic and social conditions of the country and raising its standard of living.

This mission, organized in collaboration with FAO, UNESCO, and WHO, is under the direction of Mr. M. H. L. Keenleyside, Deputy Minister of Mines and Resources in Canada. Its membership is composed of fifteen experts, chosen from eleven different countries of Europe and the Western Hemisphere. The main objects of its study will be public finance, administration, transportation, forestry, agriculture, exploitation of the mining industries, social legislation, and education.

The expert on forestry, Mr. Henry S. Kernan, was recommended by FAO for this appointment. Mr. Kernan's experience has covered all major phases of forestry in the northeastern, southern, and far western sections of the United States, in eastern Canada, and in Colombia and various other South American countries. He has worked for federal and state agencies and private industry. He also manages his own forest lands and operates his own sawmills. He has lectured on forestry and written numerous articles on various forestry problems, many of which have been published in the magazine of the American Forestry Association.

News of the World

The items appearing here are condensed selections of news thought to be of interest to readers of UNASYLVA. *They are grouped alphabetically by countries under headings currently used by the Division of Forestry and Forest Products for reference purposes. The Editor will be glad to receive direct from readers authenticated items of interest and of news value for this part of the review.*

General

ALBANIA

• Albania is comparatively well supplied with forests. According to latest publications, the area classed as forest comprises 1,100,000 hectares or 41 percent of the entire land area, but the area actually covered with forest growth is nearer 992,000 hectares. Of this, 496,000 hectares (50 percent) are high forest; 179,000 hectares (18 percent) are coppice forests; and 317,000 hectares (32 percent) are brushwood, called "maguis." Among the hardwoods, oak (38 percent) and beech (32 percent) are the predominant species; other miscellaneous hardwoods form 6 percent and ash only 3 percent. Conifers constitute 21 percent of all the standing timber.

Albanian forests divide themselves into four altitudinal zones: (1) A lower vegetational zone extends to 200 to 350 meters above sea level. This is made up of low trees and woody shrubs like the stone oak, mastic tree, tree-like heather, etc., reaching a height up to 5 meters and interlaced with thorny lianas. They have hard evergreen leaves. The "maguis" occurs largely on the southern and western slopes of lower Albania, forming extensive stretches along the entire maritime belt of Epirus; (2) The lower forest zone extends up to 1,000 meters above sea level. This is a zone of sparse oak forests, often mixed with beech, walnut, poplars, ash, etc; (3) The high mountainous forest zone extends from 1,000 to 1,700 and even 2,000 meters above sea level. This is the beech zone. On the highest points, beech is replaced by black pine and spruce; (4) The Alpine zone—1,700 meters above sea level—with alpine meadows.

The most valuable forests are located in the northern and northeastern regions of the country to which access is difficult; all forests have suffered a great deal from reckless cutting in the past and especially during World War II. Annual growth is estimated at slightly over 3,500,000 m³; of this, one-third is usable only as fuelwood. The lumber industry in Albania before the war operated 13 sawmills, but most of these were destroyed during the war. During 1946-49, the old mills were repaired and some new mills constructed. In 1948, Albania had 24 steam and waterpowered sawmills turning out 54,000 m³ of sawn lumber annually. This volume is to be increased to 75,000 m³. In 1949, the lumber industry had increased its production over 16 percent above the prewar level. Before the war, Albania imported each year 10,000 m³ of timber, chiefly sawn lumber. It exported fuelwood (5,000 metric tons), charcoal (3,000 metric tons) and a few boards and logs; also 300 to 500 metric tons of oak acorn cups (valonia—used for tannin extraction). Present exports are said to comprise valuable oak and beech lumber, parquet flooring, veneer and veneer logs, charcoal, and valonia.

The administration of the forests is centered in the Ministry of Agriculture and Forestry. In order to restore the productivity of the forests, the annual cut is deliberately kept below the annual growth, i.e., below 3,500,000 m³.

AUSTRALIA

• The Forestry School at Canberra opened the 1950 session with 80 students representing all states in Australia, as well as students from Burma, New Guinea, New Zealand, the Philippines, and Thailand.

ITALY

• A report by the Head of the Forest Administration for Sicily gives details on the difficult reforestation problems encountered on the largest island in the Mediterranean. Of the total area of 2,570,000 hectares, 6.8 percent forms the coastal plain, 34.3 percent is low hills, 39.6 percent hills from 300 to 700 meters in altitude, and 19.3 percent mountains over 700 meters. Rainfall is distributed unequally both between the mountain and plain areas and between the seasons. Average precipitation during winter and autumn amounts to 526 mm., while during summer and spring it amounts to 204 mm. One of the most densely populated parts of Italy, Sicily in 1936 had a population of 4 million inhabitants.

The present forested area may be estimated at approximately 105,000 hectares, or only 4.3 percent of the aggregate farm and forest land area of the island.

Reforestation was begun in 1878. However, even as late as 1936, only 14,000 hectares (included in the above-quoted aggregate figure) had been reforested and this at a prohibitive cost. In the meantime, however, reforestation techniques have been perfected.

The Lauretum level on the coastal plains and the interior up to an altitude of 800 to 900 meters comprise coastal sands, calcareous and clayey-calcareous soils, and finally clays. Once the sand dunes have been fixed by graminaceous plants (*Psamma arenaria*) and reedlike grasses (*Saccharum aegyptiacum*, etc.) and later by plantations of *Tamarix gallica*, reforestation can be carried out with *Pinus pinea*, *P. halepensis*, *Cupressus sempervirens*, and *Eucalyptus rostrata*. On the calcareous or clayey-calcareous soils, best results are obtained with seedlings of *Pinus pinea*, *P. halepensis*, and plantations of *Cupressus sempervirens*. A mixture of seedlings of *Pinus pinea* and *Quercus ilex* has been used successfully in recent years. Finally, in clayey soils, best results are obtained with *Eucalyptus rostrata*, elm, and two types of oak, *Quercus ilex* and *Q. sessiliflora*. On the Castanetum level, where calcareous and clayey soils predominate, use is made, depending on the nature of the terrain, of *Quercus sessiliflora* and *Q. cerris* or else of *Castanea sativa* and *Pinus laricio*. Finally, on the Fagetum level, *Pinus laricio*, *Abies pectinata*, and the European beech are grown. Reforestation of the volcanic lava and sands around Mount Etna is the most difficult problem because the high temperature of the soil due to its dark color causes the burning of the collar of the young plants.

As far as the future is concerned, it should be kept in mind that all of Sicily's 254 watercourses are torrential in flow; 80 have already been classified as mountain watersheds. These classified watersheds alone cover a surface area of 1,154,000 hectares of which an estimated 732,000 hectares should be included in cropland and forest water supply regulation and pasture improvement work.

Unfortunately, the funds now available to the Forest Adminstration will not allow reforestation of more than a thousand hectares per year, and at this rate over a century will be required to complete the work envisaged on the classified watersheds alone.

The eucalypt appears to be the most advisable species for reforestation purposes under the varying soil and climatic conditions of the island. *Eucalyptus rostrata* is planted most widely, although *E. globulus* is grown on deep wet soil and *E. gomphocephala* on arid soils. The Snia-Viscosa concern is now studying a large-scale reforestation project using eucalypt on 14,000 hectares of land around three of the main torrential watersheds of Sicily.

ROMANIA

• In 1948, there were 7,000 students attending forest schools. There are seven technical forest schools with 3 year courses, and nine professional schools with 1½ year courses. Aside from these regular courses, there are special 2 year courses to prepare young men for en

trance to the higher forest schools. In 1948, two such forest schools of professional level were created. The Bucharest Polytechnical Institute has a Department of Forestry well equipped with laboratories, and, besides teaching, also conducts forestry research.

United States of America

• The pulp and paper industries of the northeastern United States are sponsoring the Northeastern Pulpwood Research Center, at Gorham, New Hampshire, which will concentrate on the study of wood management, timber harvesting methods, and the testing of new equipment. Nine Maine companies, anxious to learn the best management methods for their forests, have also initiated an interesting research method. They have purchased 3,800 acres (1,540 ha.) of land near Bangor, Maine, including all-age stands of a wide variety of species, which will be administered by the United States Forest Service, or, more precisely, by the Northeastern Forest Experiment Station. This land has been leased to the Forest Service for 99 years. In this new forest, called the Penobscot Experimental Forest, management methods applicable to spruce and eastern balsam fir particularly will be studied. These studies will also cover the marketing of forest products; the money realized from the sale thereof will be used to pay taxes and fire protection costs; any excess profit will be redistributed among the Maine companies which own the land. These companies will pay the cost of road construction, but all other costs will be borne by the U. S. Forest Service. There will be a permanent staff of four men doing forestry research.

• The Forest Farmers Association, which groups the small forest owners of the southeastern United States, recently devoted an entire issue of its monthly magazine to the *Forest Farmer Manual*.

In an introduction to this Manual, the President of the Association states that the small forestland owner of the southeastern United States "has available to him a wealth of information which is scattered in publications of many kinds. The problem has been to be able to find the right information when needed. . . . In this Manual we have tried to bring together a part of the answers to some of the more common questions and problems."

Thanks to the collaboration of the United States Forest Service and of many experts in this field, this program has been realized remarkably well. The various sections deal with the following topics: trees and forests in general, management of southern forests, reforestation, forest protection, harvesting, measuring, marketing of lumber, wood preservation, naval stores, other uses of forests, and home forest industries. Finally, the last section gives a list of official or private, Federal or State organizations, which are in a position to furnish technical advice or to conduct research along these lines, and which are ready to assist small forestland owners in the South in the management of their resources for their benefit and in the best public interest.

The *Forest Farmer Manual* will doubtless be of invaluable assistance to the small timberland owners of the southeastern portion of the United States. In any case, it is a model which should be imitated for forests throughout the world wherever private ownership raises similar problems.

Union of Soviet Socialist Republics

• The Karelo-Finnish Republic is one of the most densely forested republics of the U.S.S.R. Forests occupy nearly 60 percent of its area, and the timber industry forms its main economic activity. The forests of the northern and central parts are chiefly pine forests (pine accounts for 60 percent of all timber stands in the country); in southern Karelia spruce predominates (33 percent of the volume) with some broadleaf species (7 percent). Over 80 percent of all the forests are mature and overmature. Pine trees 450 years old are not uncommon. These forests need to be cut over, and at an early date, so as to make possible a growth per hectare of 2 3/5 m^3 a year instead of the present 1 m^3. One of the methods advocated is to undertake immediate large-scale mechanized clear-cut logging in the pine forests. Such concentrated clear cuttings, it is claimed, facilitate the natural reproduction of pine which is an intolerant species. On account of thinness of the soil, however, skidding operations should be spread over a wide area so as not to tear up the fertile top soil layer which takes thousands of years to form. On the other hand, northern pine, for successful natural regeneration, requires that the ground be stirred up. That can be accomplished either by properly organized logging operations in summer or by harrowing or by piling and burning the slash resulting from logging. No broadcast burning of the slash should be permitted. On very poor soil, the slash after logging should be scattered and allowed to rot on the ground so as to enrich the soil. When the debris is left on the ground, every 50 to 100 hectares of the cut-over land must be broken up by areas from which all the inflammable material is removed as a fire protection measure.

In spruce forests, concentrated clear cuttings are often followed by birch and aspen taking the place of spruce. This is not such a great disadvantage now as it would have been 25 years ago, since birch and aspen have now become very valuable species, but it is essential that the spruce forests should be maintained. Clear cutting in spruce, if practiced at all, should therefore be accompanied by careful saving of the spruce undergrowth and by leaving a large number of spruce seed trees, as well as by early releasing (five to eight years after cutting) of the young spruce seedlings from suppression by birch and aspen. Since the climatic conditions are on the whole favorable to tree growth, reliance for the perpetuation of the forests should be on natural regeneration and not on artificial sowing and planting. Extensive forest fires are still prevalent. The abundance of water everywhere from the 40,000 lakes should, however, provide an effective means of fighting forest fires. Similarly, the creation of watershed protective forests along the White Sea—Baltic Canal, as well as around a number of lakes of importance as water reservoirs and for fishing, must be undertaken.

Fundamental Science

Indonesia

• *Agathis loranthifolia*, introduced in West Java from Ambon a century ago, is one of the most promising timbers. Investigation of plots in plantations made in wet mountain climate and on young volcanic soils from 550 to 1,100 meters above sea level have now made it possible to prepare yield expectancy tables. Mean annual growth appears to culminate at about 25 m^3 per hectare at an age of 35 years, but it is probable that, depending on the aim of production, a longer rotation may be desirable. Natural regeneration is relatively simple, and probably the selection system would be more desirable than the uniform shelterwood system, since it will better conserve the soil on the mountain sites. Information on the yield as controlled by density of the stand has indicated the thinning schedule which will be most likely to produce high quality trees.

Silviculture and Management

United Kingdom

• A new horse-drawn implement has been devised in England for the specific purpose of dealing with the ordinary bracken which is a pest in potential planting areas or on those which are being replanted after clear-cutting. In tests, the new implement has been more effective in suppressing bracken than the usual practice of cutting with scythes. Operation is also cheaper, the cost of machine bruising being somewhat less than half that of handwork.

United States of America

• Ponderosa pine silviculture to date has been limited to harvesting mature and overmature stands in virgin forests, to leaving adequate reserve stands of lower risk individuals, to protecting advance reproduction, to encouraging reproduction after logging, together with protection of the stands against fire. The very success in obtaining and protecting reproduction has now given rise to certain difficulties. Over vast areas, exceedingly dense sapling and pole stands have developed. These are giving excellent growth on the superior sites, but on very extensive areas the growth is poor because the stands are too dense and only a small fraction of the growth which would be obtained by more open stands is taking place. Moreover, due to the effectiveness of fire control, associated species such as Douglas fir (*Pseudotsuga taxifolia*), white fir (*Abies concolor*), and incense cedar (*Libocedrus decurrens*) are reinvading and recapturing the ground under an overstory of ponderosa pine. The density of the young growth stands is having an adverse effect on the overstory of old trees, making them abnormally susceptible to insect attack and disease. Moreover, the forage produced under the more open stands of ponderosa pine, and available for both domestic stock and wild game, has been reduced to the vanishing point. Fire hazards are increasing rapidly as more and more debris piles up under the stands.

Thinning of these overdense stands on an economically remunerative basis is

possible only on limited areas, and the problem of utilizing the material which should be removed by thinning has not been solved as yet. There is a question whether the cost of removing the associated species, in order to maintain the pure ponderosa pine type, is justified. Intensive silviculture is in general still far in the future. Work is under way on an experimental basis to determine whether it is feasible to control density of growth stands by carefully controlled burning and, although results are not conclusive, there does appear to be some chance that this technique may help solve some of the problems.

• The Forest Genetics Institute of Placerville, California, which hitherto has been working with pine, recently began research on the breeding of Douglas fir (*Pseudotsuga taxifolia*) through hybridization.

The techniques already worked out for pine were used, but with rather extensive adaptations. These changes in methods of procedure were necessary because of the difficulty of collecting a sufficient quantity of pollen from the male catkins and of accurately determining the period of receptivity of the female flowers. In particular, mention should be made of a new type of pollination syringe which projects a cloud, instead of a simple spray, of pollen upon the cones to be fertilized, thus economizing on the quantity of pollen necessary.

At the same time, experiments were conducted on self-pollination, intraspecies crossing and interspecies crossing between *Pseudotsuga taxifolia* and *P. macrocarpa*. The number of experiments underway since 1947 are still too few to reach any definitive conclusions concerning them. However, experiments on the comparative rates of seed germination obtained by artificial pollination prove that an effective control over the rate of germination is possible by this method.

Trees which were self-pollinated produced no sound seeds; this result was expected. An artificial cross between individual Douglas fir trees yielded seed, the great majority of which were sound, whereas wind-pollinated trees produced only a very small number of sound seed proportionally. A cross between a male (*P. macrocarpa*) and a female (*P. taxifolia*) produced only three apparently sound seeds out of 438, but even these three seeds did not germinate.

The method of interspecies crossing does not seem to offer as many chances of success with Douglas fir as with pine, because there is a much smaller number of species of fir. However, the possibility that an epidemic may occur and that the main method of combating it would be interspecies hybridization must always be kept in mind. On the other hand, the wide variation in the geographical area of distribution of the Douglas fir means that it will probably be possible to cultivate varieties which are both rapid in growth and easily adaptable to the conditions of any specific site.

Union of Soviet Socialist Republics

• Experiments in stimulating root production of aspen cuttings by chemicals have been conducted in one of the forests of the Far Eastern Region. The chemicals used were heteroauxin and naphthalene acetic acid. Cuttings of the fragrant aspen in winter condition were kept in a water solution of these chemicals for 24 hours before planting. The concentration of the solution was 200 mg. per liter of water. One gram of these chemicals is sufficient to treat 4,000 cuttings. By 15 August 1949 it was calculated that 34.6 percent more cuttings had established roots when treated with heteroauxin and 21 percent more when treated with naphthalene acetic acid, than untreated cuttings.

Forest Protection

Union of South Africa

• An uncommon and interesting use of television in fighting forest fires appears to have been applied for the first time in Bechuanaland. In April 1949 two planes, one equipped with a television camera and the other used as a relay, were flown along the front of a vast forest fire stretching for about 20 kilometers. The pictures broadcast gave the Forest Inspector in his office a general view of the advance of the fire and of the various phases of the struggle against it conducted several kilometers away by the forest rangers, farmers and firemen who had been called to the area; this "first-hand information" allowed for effective command decisions in fighting the fire.

United Kingdom

• A new order, effective 15 October 1949, has modified the rules regarding the import of forest trees into the United Kingdom. Import of the principal coniferous genera is prohibited because of the risk of introduction or diseases and pests from which the country is as yet free. The genus *Castanea* has been added to the list in view or the danger of introducing chestnut blight (*Endothia parasitica*). The genus *Ulmus*, or at least disease-resistant species and strains, may now be imported. The genus *Populus* has been included in the order, but it will still be possible to obtain a license to import very small quantities of species and strains unless they are known to be highly susceptible to disease or pests.

United States of America

• A survey of 151 representative water-supply reservoirs throughout the United States made prior to the war showed that one-third of them were losing their storage capacity at a rate of more than 1 percent annually, and more recent surveys indicate that this loss rate is probably conservative, particularly for reservoirs between the Appalachian and the Rocky Mountains. It was originally estimated that 21 percent of all the water-supply reservoirs would have a useful life of less than 50 years, but it now appears that no less than 33 percent will have to be supplemented or replaced within the 50-year period. These facts are alarming because many cities have already used the most economical reservoir sites; replacement will involve an exceedingly heavy cost because, in many areas, ground water supplies have been overdeveloped and surface water will have to be used to supply the growing population's increasing per caput consumption and increased industrial needs for water. Moreover, erosion rates increased markedly during the war because of more intensive and sometimes ill-advised use of the land. The cost of storage losses now amounts to about one tenth of the water bill and is likely to grow relatively more important.

Although there are various methods of directly controlling reservoir silting, all are very costly whatever their technical advisability. Thus, for most reservoirs, the only practical solution to the sediment problem is the protection of watershed lands and water courses against preventable erosion and sediment production.

Utilization

United Kingdom

• Visitors from all parts of the world to the 1951 Festival of Britain Exhibition in London are to pass through a specially erected entrance designed to "strike a blow for timber." The roof of the entrance building will be supported by five parabolic-shaped, glued laminated arches of Douglas fir (*Pseudotsuga taxifolia*), each 62 feet (19 m.) at its apex and with a span of 101 feet (31 m.). The timber industry of British Columbia, Canada, has made a gift of 14 standards of selected common grade Douglas fir from which the arches are being constructed.

• Five design sheets issued by the Timber Development Association Ltd. deal with a system of construction suitable for different spans up to 26′ 0″ (7.92 m.) between walls and for 2 main pitches, i.e., 40 degrees for plain tiling and 35 degrees for interlocking tiling. The self-explantory designs, with full legends, satisfy the following main requirements: (1) to secure over-all economy in timber consumption; (2) to reduce the demand for lengths in standard sizes and to enable random lengths to be used; (3) to enable timber in available qualities to be used with safety; (4) to avoid the necessity for load-bearing partitions on the first floor; (5) to encourage prefabrication and modern assembly methods; (6) to reduce the time taken on site between the completion of the walling and the covering of the roof.

These constructions are based on the use of timber of a grade not lower than that described as 800-pound "f quality" in British Standard 940, parts 1 and 2, which in general may be drawn readily from the unsorted and 5th qualities of European redwood and whitewood, or marketable qualities of Douglas fir (*Pseudotsuga taxifolia*), Western hemlock (*Tsuga heterophylla*), and Sitka spruce (*Picea sitchensis*).

United States of America

• Recently a study was made to investigate possibilities for profitable utilization of thinnings from a 32-year old stand of white spruce (*Picea glauca*)

in New York State. By special cutting of the very small logs it was possible to produce slab siding which was in demand for construction of log cabins, as well as lumber which came from the center of the logs. It is believed that this special form of utilization offers great possibilities for profits from thinnings, especially where no ready market for the material as pulpwood is available.

• The wood-using industries in and near the city of Spokane, Washington, have recently combined in a program of integrated utilization of wood leftovers from various manufacturing operations. First, an organized system of fuel segregation, storage, and distribution was established. Contractual agreements with 30 wood-using plants were made and over 200,000 cords (420,000 m^3) of wood were handled, principally as fuel. Facilities for storage permit the collection and segregation of material to assure wood-users a year-round supply. Since fuel is a relatively low value utilization, steps have been taken to increase the return from the leftover products. A wood flour mill with a daily capacity of 40 short tons (36 m.t.) utilizes white pine shavings. A Pres-to-log briquetting plant of 7,000 short tons (6,400 m.t.) per year capacity is in operation. Dry resaw sawdust is segregated and sold for the manufacture of floor-sweeping compounds. Other uses are under investigation, including manufacture of a fiberboard combining gypsum and wood, fiberboard of carbonized wood, and use of bark of ponderosa and white pines as a filler in plastic product manufacture.

Economics and Statistics

French Cameroons

• About US$1,600,000 worth of American machinery and other equipment has gone into a sawmill and logging camp now being established by a French firm at Eseka in the jungles of the French Cameroons. The Economic Cooperation Administration supplied $400,000 worth of aid, and the U.S. Export-Import Bank, $1,200,000.

Union of South Africa

• Before the war, the Union of South Africa imported few tropical hardwoods from Portuguese East Africa and other adjacent territories. Small amounts of Okoumé and some of the African mahoganies were taken, but most of the 3 million cubic feet (85,000 m^3) of hardwoods came from Europe, North America, or the Far East. Then, these sources of supply were shut off. Moreover, alternatives for the coniferous timbers had to be found, since hardly more than one-fifth of the normal requirements of 30 million cubic feet (850,000 m^3) could be supplied from government and private plantations in the Union. Thus greater interest was aroused in the African hardwoods, both those to supplement former hardwood imports and those which could be used to some degree as substitutes for the softwoods. At the present time, about 45 species from Portuguese East Africa alone enter the markets of the Union, and, for these, very satisfactory data have been systematically compiled by the Forest Products Institute of Pretoria and the Forest Products Research Laboratory in the United Kingdom. The data available for each species include the scientific name, standard and other common names, general character of the tree and the forest in which it occurs, sawing, seasoning techniques, description and characteristics of the wood including the usual weight, strength, shrinkage, structure, and preservative treatment required, working properties, and the uses to which it is best adapted. The total number of species imported into the Union from African suppliers numbers over 150.

United Kingdom

• Since on most private woodlands in Great Britain the operation must be profitable or forestry will not be undertaken, a study has been made of the probable returns for Scots pine (*Pinus sylvestris*), European larch (*Larix decidua*), Norway spruce (*Picea abies*), and Douglas fir (*Pseudotsuga taxifolia*). In all cases, the assumption was made that the average yield would be 80 percent of the volumes in British yield tables, that an average of 90 percent of the maximum control price was to be expected, and that normal forests worked on a sustained yield basis would be those considered. The calculations show that Douglas fir was the most profitable species on all sites from best to poorest, that European larch would show a net profit on all but the poorest sites, that Norway spruce would show a moderate profit on the two better sites and a loss on the two poorer sites, and that Scots pine would show a loss on all sites. The best possibility for profitable management of Scots pine is to use natural regeneration with a consequent reduction in cash outlays.

Policy, Legislation, and Administration

Canada

• Annual precipitation over the southern portions of the prairie provinces is very slight, varying from 11 to 20 inches (28 to 51 cm.). Losses from surface evaporation and transpiration of plants are on the whole higher than the amount of rainfall received, so that the economy of those provinces depends primarily upon the run-off from the Saskatchewan River watershed on the eastern slope of the Rocky Mountains in Alberta. The summer flow of the Saskatchewan is derived in great part from melting Rockies' glaciers, but many of these glaciers are disappearing, so that the flow of water to the river is expected to be seriously diminished in a matter of decades. Consideration has been given to the best way of meeting this situation. Since the Saskatchewan drainage basin is located in Alberta, the vast forests that the Alberta Government owns in that area were placed under the administration of a Board consisting of three members, two of whom were appointed by the Dominion and one by the Province of Alberta under an agreement reached in 1947 between the Province and the Dominion. The Dominion Government has provided Can$6,300,000 for capital investment over the first five years of the life of the agreement for road construction, buildings, equipment, and forestry and water control research projects. The Province defrays the cost of maintenance and administration up to a minimum of $125,000 and a maximum of $300,000, depending on the revenue it derives from the forests managed by the Board. The Dominion Government pays the difference between the actual cost and the contribution of the Alberta Government. The Board has been mainly concerned so far with research work (vegetation, soil and range surveys, establishment of meteorological stations and stations for the metering of the stream flow); fire prevention and fighting (development of a system of roads and trails), and the co-ordination of the activities of various agencies interested in the development of the resources of the Saskatchewan basin (irrigation projects, erection of hydroelectric plants). The Board has a staff of its own, but co-operates fully with the Provincial Forest Service of Alberta. This is an original pattern of collaboration between the Dominion and the Provinces, being applied to the most extensive program of conservation and management of natural resources in Canada.

Finland

• The government took measures to alleviate unemployment in Finland during the winter 1949/50 by appropriating considerable sums for various work projects, such as forest improvement work on private estates. This work, principally consisting of removal of timber and waste from cutting areas, cleaning of seedling stands, and thinning of young stands was directed by the district forestry boards appointed under the Private Forest Law. The total area of private forests worked over is estimated at about 14,000 hectares. Moreover, subsidies have been granted for similar work in state forests.

Improvement of floatways had been undertaken with previous appropriations of this type.

Hungary

• Hungary is recognizing the vital importance of forests in its national economy by planning long-term restoration of its forests in the interests both of protection and of self-sufficiency in timber production. A recent bulletin has announced that a Five-Year Plan was initiated on 1 January 1950, as the first part of a long-term program involving both the restoration of its existing badly depleted forests and the afforestation of vast areas. This program, which is to remedy the effects of decades of neglect and overexploitation of the forests of Hungary, has, it is stated, received great impetus from the large-scale afforestation plan now being executed by the U.S.S.R., and which stresses the great economic importance of establishing forests on prairies and sandy areas.

The present annual timber cut is estimated at about 1.2 million m^3 as against requirements estimated at 6 to 7 million m^3, while the existing forests now cover only 12.6 percent of the total area of the country; it is estimated that to afford

adequate protection against the increase of barren, water-eroded lands now estimated at 30,000 to 35,000 hectares and to meet production requirements, an area of between 20 and 22 percent should be under forests properly conserved and efficiently managed.

The new Five-Year Plan provides for reforestation of approximately 65,000 hectares of land already cut-over or to be cut-over during the period; afforestation of approximately 28,500 hectares primarily on loose sandy soil and on certain alkaline areas on the great plains (one main feature of this afforestation will be the provision of windbreaks and shelterbelts for the protection of agricultural lands, crops, and stock); and the establishment of experimental stations totaling 8,500 hectares for research into silvicultural techniques.

Long-term plans aim at rehabilitating existing forests and establishing new forests to the extent that in 40 years Hungary should be self-sufficient in forest products and should have adequate protection for its agricultural economy.

India

• The government has reconstituted the Forest Advisory Board. It will advise on priority of research at the Forest Research Institute in Dehra Dun, co-ordinate forest research needs with those of agriculture and industry, and will link research with needs of producers and consumers.

United States of America

• In January 1946 the State of Washington made the enforcement of its Forest Practice Act compulsory. This Act provides that the regeneration of cut-over timberlands must be assured by the owner of such land. It requires the maintenance of seed blocks equal to at least 5 percent of the harvested area under the clearcut system, or of all trees below a specified diameter in a selective system of cutting. In the event that neither of these systems is applicable, the owner concerned may file a prior cutting plan for natural restocking or else post a bond guaranteeing such natural regeneration within five years. If by the end of that time the area has not been completely restocked, the bond is called and the Washington State Forest Service plants the area.

The constitutionality of this Act was contested by a group of timberland owners whose claim was supported by the local courts; however, the decision of these lower courts was reversed by the Supreme Court of Washington State.

The U.S. Supreme Court, in a decision handed down on 7 November 1949, upheld the finding of the Supreme Court of the State of Washington, definitely confirming the constitutionality of the Forest Practice Act, and establishing the prerogative of the states to control the use of this natural resource for the benefit of the states themselves and of the nation as a whole.

• The President has established the Water Resources Policy Commission, composed of a chairman and six other members, all of them men of outstanding qualifications and repute. The Commission will deal in particular with: (a) the extent and character of federal government participation in major water-resources programs; (b) an appraisal of the priority of water-resources programs from the standpoint of economic and social needs; (c) criteria and standards for evaluating the feasibility of water-resources projects; and (d) desirable legislation or changes in existing legislation relating to the development, utilization, and conservation of water resources. All executive departments and agencies of the federal government are directed to co-operate with the Commission. The U.S. Forest Service and other bureaus may be affected by the Commission's work. The Commission will not be concerned with organizational arrangements or the allocation of agency functions.

Reviews

A Conservation Handbook. Samuel H. Ordway, Jr. Pp. 60. The Conservation Foundation, New York. 1949.

This handbook summarizes the various aspects of conservation as "the planned management and wise use of nature's resources—as a whole as well as severally." The author briefly describes nonrenewable and renewable natural resources. Stress is given to the important concept that all renewable and natural resources are interdependent and that conservation of one can only be achieved by measures designed to conserve them all while realizing at the same time that man is part of the pattern which must be conserved. Approaches to conservation practice by means of surveys, plans, use of technicians, conservation districts and regional planning, are dealt with in a short chapter. Land-, forest-, range-, water-, and wildlife-management are each discussed in a separate brief chapter. Under land management, the types of erosion and methods of checking together with methods of preserving and restoring soil fertility are described.

"Forest management seeks to increase forest growth and harvest to achieve optimum continuous wood production or watershed development or growth of forage and habitat for animals . . . or maximum opportunity for human study and recreation or the most practical combination of these uses of a forest area." On range management, the necessity to avoid overgrazing with its attendant evils is stressed and the measures required to build up range carrying capacity are described.

"Water management seeks to make available the maximum possible amount of water at times and places where it is needed . . . and that its destructive force be checked so that it will not destroy other resources and human life and property." Water conservation and flood control and the necessity for avoiding pollution of streams is also discussed.

The author states that wildlife management aims to ensure an abundance of animal life without encroaching upon agricultural economy by protecting their habitat and food supply, and by protecting them against predators, including man. Research into breeding habits and feeding requirements is an essential phase of this work.

Técnica Defectuosa Como Causa de Pérdidas en Las Plantaciones de Pino Insigne. (Losses in the Monterey Pine Plantations Caused by Defective Technique.) Eduardo Torricelli D. and Dagoberto Muñoz V. Pp. 15. Departamento de Bosques, Dirección General de Tierras y Colonización, Santiago de Chile. 1950.

The extensive plantations undertaken in Chile for a number of years with Monterey pine (*Pinus radiata*), locally known as "*Pino insigne*," have shown a wide variation in results especially in the percentage of survival of young trees. The Forestry Department undertook an investigation of the causes of losses, in order to make specific recommendations, and their results are reported in this bulletin.

The factors influencing plantations are analyzed as follows: (1) time of the year for planting; (2) handling of plants; (3) methods of planting; (4) preparation of the field; (5) selection of plants.

A good deal of technical experimentation and field research was involved in this study and the results are clearly set forth. The bulletin should prove valuable in improving the planting techniques of the country.

Publications Received

An International Index of Films on the Conservation and Utilization of Resources. Prepared for the United Nations Scientific Conference on the Conservation and Utilization of Resources (UNSCCUR) August-September 1949. Pp. 175, illus. United Nations, Lake Success, N. Y. 1950.

Proceedings of the United Nations Scientific Conference on the Conservation and Utilization of Resources, 17 August-6 September 1949, Lake Success, New York. Vol. 1, Plenary Meetings. Pp. lxi + 431. United Nations, Department of Economic Affairs, Lake Success, N. Y. 1950.

Insect Enemies of Eastern Forests. F. C. Craighead, United States Department of Agriculture. Pp. 679, illus. (Misc. publ. No. 657). U. S. Government Printing Office, Washington, D. C. 1950. $2.50.

Wildlife Management (Upland Game and General Principles). Reuben Edwin Trippensee. Pp. 479, illus. McGraw-Hill Book Company, Inc., New York and London. 1948. $5.

Erratum

Vol. IV, No. 2

Page 94: A. A. Wyn, Inc., New York, is the publisher of *Green Glory — The Forests of the World*, by Richard St. Barbe Baker.

Planning A National Forest Inventory

The first in a new series of Forestry and Forest Products Studies. Prepared by FAO after extensive investigation, this study is intended to be of service to those who may be required to plan large-scale forest inventories. The book, of approximately 100 pages, will be available shortly from FAO sales agents; price US$1.00.

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